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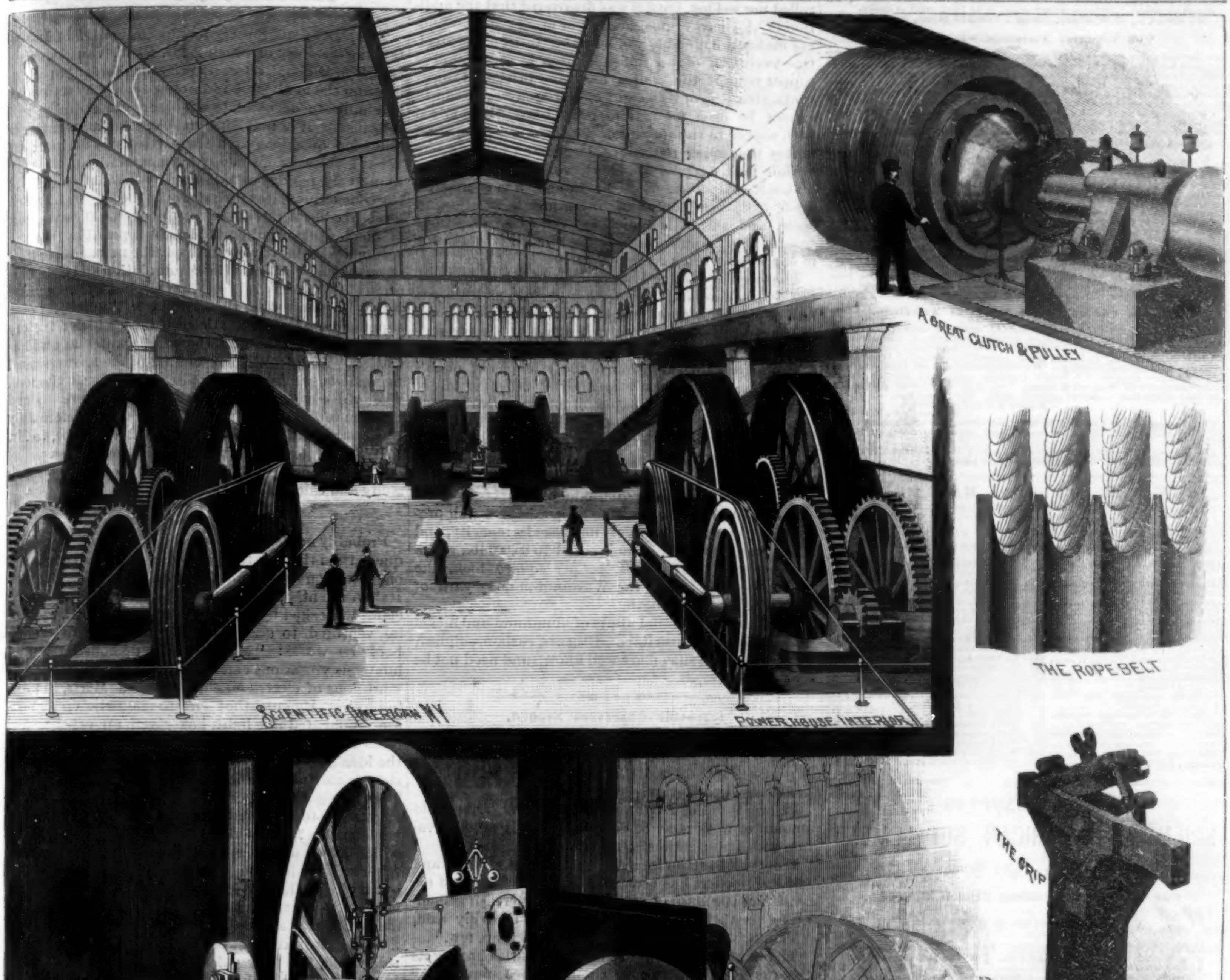

THE THIRD AVENUE RAILROAD COMPANY'S NEW CABLE TRACTION PLANT.—[See page 135.]

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 948.

For the Week Ending March 3, 1894.

Price 10 cents. For sale by all newsdealers.

INFLUENCE OF SMALL PORTIONS OF ALLOY ON THE PROPERTIES OF METALS.

Exact alloys of metals are often difficult to make, and with many a very small quantity of alloy greatly affects their qualities and produces some peculiar and unaccountable phenomena in working the metal.

The presence of $\frac{1}{2000}$ of an ounce of antimony per pound of lead increases the rapidity with which it oxidizes and burns in the melted state. Lead containing more than $\frac{1}{1000}$ of an ounce of copper per pound is unfit for the manufacture of white lead, on account of its coloring properties. Gold, with an alloy of $\frac{1}{2000}$ of its weight of lead, is extremely brittle. Nickel was regarded as a metal which could be neither hammered, rolled nor welded, until it was discovered that the addition of $\frac{1}{1000}$ part of magnesium or of $\frac{1}{1000}$ of phosphorus makes it malleable and weldable to iron and steel. One-twentieth of an ounce of iron to one pound of copper renders the copper hard and brittle. Copper containing $\frac{1}{1000}$ of its weight of antimony or bismuth cannot be used for making rolled brass. Zinc mixed with copper to the amount of $\frac{1}{16}$ of an ounce per pound makes the copper red short. One-sixth of an ounce of arsenic makes copper hot short, while ⅛ of an ounce makes it cold short. Some of the copper of commerce, made from ores containing other metals, sulphur, arsenic, and silicon, is sometimes the cause of serious trouble with manufacturers in the rolling and stamping of copper and brass goods.

The electric conductivity of copper is largely modified by small admixtures of other metals, as with one half of one per cent of iron its conductivity is reduced 60 per cent, as also with varying alloys of other metals of low conductivity.

The remarkable addition to the strength of metals by the fractional mixture or alloy of other metals or substances is a notable feature of modern metallurgy.

Copper having a tensile strength of 25,000 lb. by an addition of six per cent of tin may be equal to 28,000 lb., but with the addition of one to two per cent of phosphide of tin and copper its tensile strength is increased to 80,000 lb. or more per square inch.

The addition of aluminum to copper in the small proportion of one per cent largely increases its tenacity, and at 7½ per cent aluminum is equal to 60,000 lb., and a ten per cent alloy 90,000 lb. per square inch, the highest being a test at the Washington navy yard of 114,000 lb. tensile strength.

The minute fractional alloys of aluminum and nickel with steel, as well also its constituents, carbon, sulphur, phosphorus and silicon, are well known and need not be repeated.

Scientific Observers Needed.

The great advance made in recent years along every line of physical science has an important significance as suggesting the possibility of attaining still higher results in a near future.

Before these can be reached, however, an untold amount of work must be done in the fields of observation and investigation.

Wonderful as the increase in number of able and faithful workers has been, still, owing to the rapid extension of the lines of work and the increasing complexity of their inter-relations, it may be truly said, "The harvest is waiting, but the laborers are few."

The universe of space has been defined as having its "center everywhere, its circumference nowhere;" likewise the explorer of science may take his position at any point in any field and find the radiant lines of correlated action stretching out toward infinity.

By virtue of a subtle intellectual prescience accorded to only a few of our race, such master minds as Newton and Descartes saw clearly the possibility of the important revelations that would some day result from a proper conception of the laws of force, form and motion, as exhibited in the phenomena of nature.

Each of these individuals, working under such convictions, made marvelous progress in the conquests of science. The great primary ideas attained by such thinkers, and the results reached by the great experimenters, such as Faraday, are the priceless possessions of to-day. And through the extension of science and art in the accumulation of facts, and improved means for investigation, we of to-day may reap an abundant harvest, made possible by those immortal pioneers when they discovered the keys that can disclose a true interpretation of the phenomena of nature.

How strange that through all the past, and even now amid the splendid progress that has so far redeemed and illumined the world, the word science has been and still is often flouted, while its pursuits, that can never be aught else but the pursuit of truth for its own sake, are still too often referred to in popular literature with contemptuous raillery. Better treatment and more enlightened teaching are still needed both from the school and the press. And this is written humbly to call attention to the latter point, and invoke consideration of its intrinsic importance. Can anything be more important to each one of our race than that he or she should as soon as possible learn as a habit to "think clearly and see straight"?

To this end the primary definitions of science should be rigidly taught, for simple as are the laws that should govern the study of facts and relations, how few, apparently, entirely master or strictly regard them.

In this way it seems to the writer, practical science ought to be more popularized.

Important results might follow, both theoretical and practical, if the great army of industrial classes were better educated to be reliable scientific observers. In agriculture and the related sciences of biology, climatology, etc., there is great need of an increase of reliable observers. And should not the re-enforcement be most available from among those whose vocations bring them constantly near to the practical study of nature?

LUM WOODRUFF.

Prize for an Essay on Wind Power.

The Netherland Society for the Promotion of Industry, the secretary of which is Mr. F. W. Van Eeden, of Haarlem, Holland, offers its prize for 1894 for papers indicating the method of obtaining energy by means of windmills, to accumulate this energy electrically, and to transmit it or make it portable. An answer to the following questions is more particularly desired: (1.) What is the average energy a common windmill is able to produce, per day of 24 hours, in combination with an electric accumulator; what would be the installation most suitable to this effect, and what would be the cost of one horse power hour? (2.) Is it possible, from an economical point of view, to apply the new aerial motors on an extensive scale for the accumulation and the utilization of this energy? If so, what mechanical appliances would be required for this purpose? The project of a supposed application of the system by which a factory is provided with light and power is wanted as an illustration. The drawings belonging to the answers must be made on white paper on a scale of ¼ in. to the foot. The prize comprises the gold medal of the society and the sum of £30. The papers are to be sent before July 1, with the author's name in a closed envelope, to Mr. F. W. Van Eeden, of above mentioned address.

A pretty small prize for a subject requiring so much study and calculation.

What is Electricity?

Probably no better answer can be given to the above query than the one that follows: It is stated that on one occasion when Professor Galileo Ferraris, the Italian scientist, whose name is known to all electricians, was asked by a young lady what electricity was, he ventured to answer it. Opening her autograph book he wrote: "Maxwell has demonstrated that luminous vibrations can be nothing else than periodic vibrations of electro-magnetic forces. Hertz, in proving by experiments that electro-magnetic oscillations are propagated like light, has given an experimental basis to the theory of Maxwell. This gave birth to the idea that the luminiferous ether and the seat of electric and magnetic forces are one and the same thing. This being established, I can now, my dear young lady, reply to the question that you put to me: What is electricity? It is not only the formidable agent which now and then shatters and tears the atmosphere, terrifying you with the crash of its thunder, but it is also the life-giving agent which sends from heaven to earth, with the light and the heat, the magic of colors and the breath of life. It is that which makes your heart beat to the palpitation of the outside world, it is that which has the power to transmit to your soul the enchantment of a look and the grace of a smile."

Flow of Metals Under Pressure.

The ability of metals to flow under pressure is frequently much affected by the presence in them of other substances. Thus common cast iron, when cold, is very slightly malleable. But if a portion of its carbon be extracted, as in the manufacture of malleable cast iron articles, it assumes a good degree of malleability, and its particles flow readily under the action of blows or under steady pressure. One of the most interesting applications of the flow of metals for constructive purposes is a machine invented, says the *Tradesman*, somewhere between 1830 and 1840, by an artist for the manufacture of the collapsible tubes now universally used for holding artists' colors. As every one knows, these tubes are exceedingly thin—in fact, no thicker than foil; yet they are made from a small cylindrical block of tin, which by a single blow of a punch is made to flow into a mould by which not only the holding part of the tube is made, but also the nipple at the top upon which the cap is screwed. The bottoms of the tubes are closed by folding them over upon themselves, and thus what would appear quite a difficult thing to make, to those unacquainted with mechanical processes, is manufactured at so cheap a rate as to add scarcely more to the cost of a tube of color than the tin foil wrapping does to the cost of a paper of tobacco.

IT has been estimated that 25,000 horses are employed in the London carrying trade, that their value is a million and a quarter, and that the cost is for food alone £800,000 a year. A rule prevails of foraging the horses on threepence an inch per week—that is, a horse costs as many shillings a week as it stands hands high.

Vegetable Silks.

Under the name of "silk grass," "silk cotton," "pillow cotton," "soie vegetale," "ouate de fromager," etc., there are grouped in commerce the silky hairs and down that cover the seeds of several plants of the orders Bombacineæ and Sterculiaceæ, such as *Bombax pentandrum*, or "kapok," of India; *B. Malabaricum*, or Malabar "silk cotton tree;" *B. munguba*, or "huimba," of Brazil; *B. heptaphyllum*, *B. Ceiba*, or "god tree," of India and Guiana; *B. Carolinum*, or "paina de imbirucu;" *B. phisianthus*, or "paina de cijio;" *Eriodendron anfractuosum*, or "kapok," of the Dutch Indies; *E. Caribæum*, or "beuten," of Senegal; *Chorisia speciosa*, or "paina de paneira femea," of Brazil; *C. Pecholtiana*, or "paina de paneira macho," of Brazil; *Stipecoma peltigera*, or "paina soeira," of Brazil; and *Ochroma lagopus*, or "hare's foot," of the Antilles and India.

In the order Asclepiadaceæ we have the *Asclepias volubilis*, of Guadaloupe; *A. gigantea*, or "madar," of Martinique; *A. curassarica*, of the Antilles and Senegal; *A. Cornuti*, of North America; *A. fructicosa*, of Southern Italy; and *Gomphocarpus fructicosa*, of Cape Tunis and Senegal.

The *Vincetoxicum officinale*, or "contrayerva," the *Cochlospermum gossypium*, of Senegal, and *C. tinctorium*, also furnish vegetable silk.

The allied order of Apocynaceæ furnishes a large number of vegetable silks, *e. g.*, the *Apocynum venetum*, found in the Crimea and Turkistan, and the *A. cannabinum*, or "Indian hemp," of North America.

The *Wrightia tinctoria*, of the Indies, also produces a silk cotton, as do also the *Echites grandiflora*, *E. conduta*, and *Beaumontia grandiflora*. From the seeds of a species of *Batatas* is obtained a textile material called "Natal cotton."

The beautiful silky fiber yielded by the above named plants, and very appropriately named silk cotton, is used wherever the plants grow, whether in India, Africa, or America, for precisely similar purposes, viz., for stuffing pillows and cushions, although it is hoped that some day a better use will be found for it. The Malabar silk cotton is used in Assam for the manufacture of a kind of quilt or thick cloth, probably by felting, as it is not adapted for spinning.

Finally, several common trees, such as the poplars and willows, yield a soft down, and some of the acacias, such as the *Acacia julibrissin*, bear flowers imitating silk, whence the name "silk tree" sometimes given it. The bark of a Chinese *Euonymus*, shown at the Exposition of 1889, contains a fibrous material that seems to be a vegetable silk, and from the stems of the *Ricinus* a sort of silk may be obtained.

At the Exposition of 1889 there was exhibited the vegetable silk called "kapok" sent by the French colonies of Indo-China, the Dutch colonies of Java and the English colonies of India and the Antilles. Kapok is the name given in Indo-China and the Indian Archipelago to the setaceous fiber surrounding the seeds of *Bombax pentandrum* and *B. Ceiba*. The trees begin to bear fruit and yield their textile material when three years of age. The countries that produce the best kapok are the islands of the Indian Archipelago, Java, Bombay, Sumatra, and the peninsula of Malacca. That of the English East Indies is less esteemed, since it is not so elastic. The fibers of the kapok are crisped and twisted like those of cotton. It has been supposed that the material was not known in Europe until 1851, at the epoch of the London Exhibition, but this is disproved by the fact that Magalotti, in 1600, in his scientific letters, describes it and says that it is called by the Dutch "sidervate," *i. e.*, silk cotton, and by the Arabs "beidelsaar," which means silk wool. He states that it is combed and spun like flax.

In 1851 it was newly presented in London by the Dutch, but little attention was paid to the product, and it was in Australia, only, that it began to find great favor. It is employed throughout this whole country in the decorative industries. In 1884, 1,000 bales were imported, and, in 1886, 8,600, 7,991 of which came from the island of Java, where is produced the most esteemed, cleanest, and the least compressed, and consequently the most elastic kapok.

The substance is used by preference to cotton for wadding for clothing, for stuffing cushions, for the manufacture of fabrics imitating beaver, and of ornaments that compete with silk. Hats are made from it in mixing it with the hair of the rabbit, and it is used for some high-priced fabrics, such as those employed for turbans, mantles, etc.

The fibers take certain dyes very well, and, with various silks differently colored, there may be obtained elegant fabrics, and velvets or imitations of feathers of a very handsome effect. Upon weaving with cotton, mixed tissues are produced that are capable of competing with genuine silk.

Kapok may be employed, too, in lieu of cotton for preparing a detonating powder by treating it with nitric acid. This nitrated kapok, mixed with pyroligneous ether, and with protochloride of iron having an organic base, yields a reduced fiber, which, differently colored, furnishes a solution of vegetable silk which solidifies in water and may be spun and afterward mixed with animal silk.—*Moniteur Scientifique.*

Influence of Decortication upon the Mechanical Properties of Wood.

Buffon and Duhamel du Monceau have taught that oaks decorticated while standing form wood that is denser and that offers greater resistance to breakage than those that are not so treated. This opinion, assailed in France by Varenne de Feuille at the end of the last century, was still more vigorously attacked in Germany at the beginning of the same century, without such attacks being based upon direct experiment. So the question has remained undecided. Mr. Mer, thinking it was of some interest to take it up, has, as a result of researches based upon a histological examination and upon the chemical composition and a determination of densities, found that, contrary to the opinion of Buffon, the sapwood of decorticated specimens preserves all the characters that distinguish it from the perfect wood, save one—the absence of starch. From this it became probable that its resistance to breakage was not increased. This, in fact, is what results from the experiments pursued by means of a special apparatus installed at the School of Forestry by Mr. Mer, and that permitted him to compare the tissues, on the one hand, of the specimens operated upon, and on the other, of those of a tree for comparison, after assuring himself that both were perfectly dry. The realization of this condition is essential, since the mechanical properties of a wood vary greatly according to its degree of humidity. It is probable that, for want of having taken such precaution, Buffon and Duhamel du Monceau obtained results that were always favorable to the trees operated upon. This is doubtless the case, because the sapwood of their subjects for comparison was slightly altered by fungi, as generally happens with trees abandoned for a certain time without bark, even in a protected place. At the epoch at which these investigators lived there were no means of recognizing such slight alterations. Decortication therefore does not present the advantages that were claimed for it, but, as an offset, it possesses others that were not suspected. It preserves wood from getting worm eaten and permits of drying it without much cracking or an incipient rotting resulting therefrom, an alternative which always besets the owner when he cannot cut up his trees almost immediately after they have been felled.—*La Nature.*

Xylolith, or Wood Stone.

Xylolith, or wood stone, is coming into extensive use in Germany. A recent number of the *Bautechniker* gives the following particulars. Xylolith, or steinholz, or wood stone, is made of magnesia cement, or calcined magnesite, mixed with sawdust, and saturated with a solution of chloride of calcium. The pasty mass, before the cement sets, is spread out into sheets of uniform thickness, and subjected to an enormous pressure, amounting to more than 1,000 lb. to the square inch. The compressed sheets are then simply dried in the air. The original invention of this material dates back to 1883, but it is only within the last five years that a single firm, that of Otto Sening & Co., at Pottschappel, near Dresden, has undertaken the manufacture of it on a large scale, and has met with such success that it is already engaged in the erection of extensive additional works in the Austrian territory, to supply the South German market. In 1888 a series of tests of xylolith was made at the royal testing station for building materials in Berlin, covering its chemical as well as mechanical qualities. In resistance to tension it was found, naturally, that dry material was much superior to the same soaked with water, dry specimens resisting a tension of about 100 lb. per square inch, while pieces saturated with water resisted only two thirds as much. Soaking the dry material in linseed oil increased the tensile strength about 16 per cent, and freezing diminished it slightly. The resistance to compression proved to be about 300 lb. to the square inch. This was diminished about 10 per cent by freezing and increased to about the same extent by careful drying and saturation with linseed oil.

The special gravity of the new substance was found to be 1·553. The fractured surfaces showed a yellow color, with a perfectly uniform, close grain. When immersed in water, unbroken sheets of perfectly dry material took up 2·1 per cent of their weight of water in 12 hours, and 3·8 per cent in 216 hours. Broken pieces absorbed in the same time about 20 per cent more water than the unbroken sheets. To try the resistance to the influences of the weather, a large number of samples were taken, and subjected to boiling in water, brine, soda lye, hydrochloric acid, and solutions of sulphate of iron, sulphate of copper, and sulphate of ammonium, alternating the boiling with sudden cooling. After several days' treatment with hydrochloric acid a loss of 2·3 per cent in weight was observed, but the properties of the pieces under test were not perceptibly affected. In the other cases no loss of weight could be detected, nor was there any other apparent alteration, and the liquids used for treating the samples remained perfectly clear. Exposure to superheated steam, in a Papin's digester, also produced no visible effect. In hardness, the material was found to occupy a position between feldspar and quartz, being scratched by the latter, but not distinctly so by the former. As a conductor of heat, the xylolith was found to rank between asbestos and cork, being, therefore, one of the best non-conductors known. To test its fire-resisting qualities, sheets were exposed for three hours to the flame of a Bunsen gas burner, by which the actual surface touched by the flame was charred, although there was no crumbling, or extension of the charring beyond the marks of the flame. Similar pieces laid on the burning coal in the fire-box of a drying oven, and kept for some time at a red heat, were rendered brittle, and crumbled at the edges, but kept their shape and cohesion, and showed no sign of breaking into a flame.

For use, xylolith is delivered in sheets, from a quarter of an inch to an inch and a half thick, and of all sizes up to a meter square. The dimensions are almost unchangeable by dryness or moisture. A sheet measuring one meter square when perfectly dry will expand from one to two-tenths of one per cent when soaked in water, and a moist sheet will contract in drying to about the same extent. Being so little subject to contraction and expansion, it is extensively used for floors in railroad stations, hospitals, and similar buildings. It is readily planed, sawed, bored, and fashioned with ordinary wood-working tools, and may be painted or decorated in the same manner as wood. It is itself nearly waterproof, and with suitable putty in the joints and a good coat of paint, it may be made entirely so. It is not surprising that a material possessing so many advantages should have come into extensive use, and we trust that its use will extend.

Test for Wintergreen Oil.

The following is an excellent test for oil of wintergreen, or birch, that is suspected of being mixed with the synthetic oil.

The theory is that while synthetic oil wintergreen is almost the same chemically as true oil, yet it being an alcoholic product it is impossible to entirely remove traces of alcohol; hence, if a small particle of red aniline soluble in alcohol be dropped into a vial of the synthetic oil it will immediately show a disposition to dissolve, which is not the case with true wintergreen. Practically this is found to be the case. In three to five minutes time, by agitating vials of both oils with aniline in them, it will be noticed that the artificial product readily dissolves the aniline, whereas the other will hardly have any perceptible effect on it. After the lapse of fifteen minutes to half an hour both will be discolored, but the artificial will have a purplish tint, while the natural oil will be more of a cherry color; and in proportion as the two are mixed, so will be the time and extent of coloration.

This is a delicate test, fit only for use by experts, for which reason we have not hitbertofore published it, as by it a careless user would probably reject all the oil he purchased, whether pure or otherwise. Before adopting it for use it will be well to make several experiments in order to get a correct idea of the length of time required for the action of pure oil wintergreen on the aniline, in comparison with the artificial or known mixtures of the two.

Soap Suds for Calming Waves.

The remarkable action of oil upon waves is well known. This phenomena led the officers of the steamship Scandia, of Hamburg, to make an experiment upon the same principle that was very successful and that appears to us worthy of mention. During its last trip to the United States, the vessel, while in midocean, was attacked by a very heavy storm. It then occurred to the officers to dissolve a large quantity of soap in tubs of water. Having thus obtained several hundred gallons of soap suds in a very short time, they threw it overboard in front of the ship. The effect was almost instantaneous, and the vessel soon began to navigate without difficulty. Her officers at once addressed a long report to the Hydrographic Bureau of the United States, giving an account of their voyage, the storm, and the means that they employed to still the waves. They conclude by saying that although soap suds does not produce absolutely all the effects upon water that oil does, it at least suffices to break the force of waves in most cases. Besides, this method recommends itself to transportation companies careful of their interests. Soap suds is much cheaper than oil, and a relatively large quantity of soap can be carried without encroaching too much upon the space set apart for passengers and merchandise.—*La Nature.*

ALUMINUM WITH TEXTILE FABRICS, CORD, ROPE.—The invention consists in weaving or intertwining threads of aluminum, either by itself or along with the material usually employed in the manufacture of cloth of various descriptions, lace, rope, cord, and the like.—*W. Darlow, Plaistow, London.*

Electrical Notes.

Referring to the low-frequency alternate current—25 per second—adopted at Niagara Falls, Mr. William Stanly, Jr., in a recent article in the *Electrical World*, shows that for the transmission of power the use of very low frequencies is not justified, and he intends to show why such a procedure is bad engineering from the transformer standpoint.

To sum up the virtues of high-frequency motors, we have, according to the author's calculations:

First.—A greater torque at all times for the material employed, and, consequently, a greater output.

Second.—A lower impedance armature and a lower inductance in the armature circuit, consequently for a given load a smaller armature current.

Third.—A smaller armature reaction and "blowing out" effect produced by armature reaction.

The experience at Pittsfield, where for fifteen months two-phased motors whose magnetizing currents are supplied from condensers have been in operation, is a sufficient proof of the practical operation of condensers. These motors are operating at 130 periods per second. They are connected to all classes of work, operating, as they do, a sawmill, a woolen factory, machine shops, a printing office, etc., and it has been found by actual observations of the voltmeter, in circuit on the consumers' premises, that the variation of potential due to changes of load and lag on the motors does not average 2 per cent of the voltage applied. The regulation of these circuits is as perfect as if they were simply operating lamps alone.

In order to carry off the heat generated in transformers working under a heavy load, Prof. Henry A. Rowland, of Johns Hopkins University, has invented a method employing a current of liquid led through the iron in tubes so placed as not to be cut by the lines of magnetic induction, the tubes and iron laminæ alternating with one another. Water or any other conducting liquid may thus be employed without interfering with the proper working of the transformer.

Another method employed by Prof. Rowland is to surround the transformer with a vessel containing a volatile liquid which, by boiling, carries away the heat. The vapor may be recondensed in the upper part of the vessel or carried off through a condensing coil and returned to the vessel in a liquid state. He also provides means for reducing the pressure in the vessel, in order that the liquid may boil at a low temperature.

To cool conductors carrying heavy currents, Prof. Rowland suggests making them hollow and passing a current of cooling liquid, such as water, through them from end to end, the liquid issuing in the form of spray to break the continuity of the stream, and thus insulate it from the vessel into which it flows.

Work has been begun on the Baltimore and Washington Electric Railway. The electric line will be only 33 miles long, while the Baltimore and Ohio's steam road is 40 and that of the Pennsylvania 42 miles in length between the two cites. Entrance has been secured both in Baltimore and Washington, and connection will probably be had in the former city with the Edmondson Avenue line of the Traction Company, which is to be converted into an electric railroad.

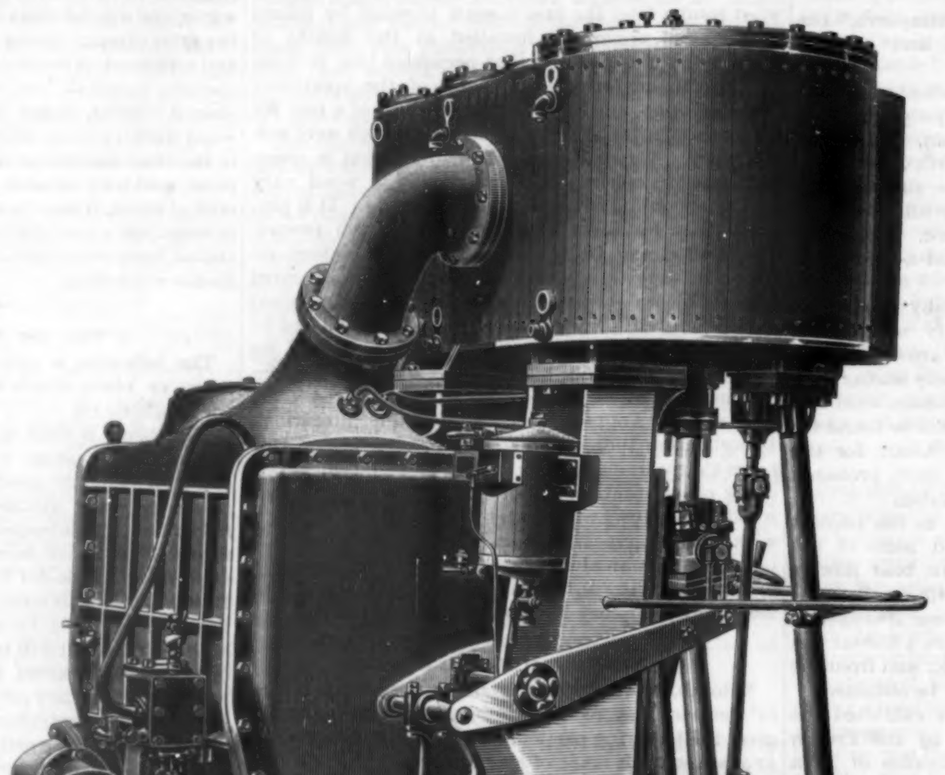
A trolley line connecting New York and Philadelphia will be built in the near future. Within the last few weeks arrangements have been made to extend the New Jersey Traction Company's lines from Newark to Elizabeth and thence to Plainfield by way of Westfield Avenue, the "county road," running parallel with and but a stone's throw from the New Jersey Central Railroad, and hence passing through all the smaller towns whose travel has been exclusively controlled by the latter road. From Plainfield the road will probably be extended through Bound Brook and from there to New Brunswick, and thence through Princeton and Lawrenceville to Trenton.

IMPROVED TRIPLE EXPANSION ENGINES.

The Condor, the engines of which we illustrate from *Engineering*, is a small composite schooner, built some time since at Havre, by the Forges et Chantiers de la Mediterranee, for the Chilean government. The following are her principal dimensions:

Length between perpendiculars	88 ft. 7 in.
Breadth	18 " 8 "
Depth	9 " 10 "
Mean draught of water	8 " 1 "
Displacement	145 tons.
Engines	250 horse power.
Speed on trials	10½ knots.
Approximate tonnage	115 tons.

This little vessel presents no special features of construction; the hull is composite, with copper sheathing over the wood and steel frames, it is divided into watertight compartments by four transverse bulkheads. The forward compartment contains the sail and cordage stores, in the next are the sleeping quarters of the men; the center compartment contains the engines, boilers, and coal bunkers; the fourth and fifth are devoted to the ammunition and general stores and officers' quarters.



IMPROVED TRIPLE EXPANSION ENGINES.

The engine, of which we publish an illustration above, is triple expansion, with the three jacketed cylinders placed side by side, and an independent condenser with brass tubes, tinned inside and out; the circulating pump is driven by a separate motor. The boiler is cylindrical, with two corrugated furnaces and return flues; the shell is of Siemens-Martin steel, and the furnace plates are of iron. The following figures give some particulars of the engines and boiler:

Diameter of high pressure cylinder	12·20 in.
" intermediate "	17·72 "
" low pressure "	26·77 "
Length of stroke	17·72 "
Number of revolutions	130
Diameter of boiler	9 ft. 6 in.
Length	8 " 7 "
Internal diameter of furnace	2 " 7⅛ "
Area of grate	20·14 sq. ft.
Total heating surface	807 sq. ft.
Authorized working pressure	149 lb. per sq. in.

CORNELIUS VERMUYDEN, the Dutch engineer, was invited to England in 1621 to embank the Fens district.

The Cause of Trees being Struck by Lightning.

The frequent striking of trees by lightning is a traditional phenomenon that is well known, but the causes of it are not so precisely known, although it is, in a manner, a primordial electric manifestation. Mr. D. Jonesco has recently made a series of interesting experiments on this subject, the results of which have been communicated by him to the Agricultural Society of Brabant.

Mr. Jonesco has ascertained that certain trees attract lightning better than others. Starting from this, he has endeavored to find out how the various forest trees behave with respect to electric discharges, and has ascertained that the greater or less conductivity of trees should be taken so much the less into consideration in proportion as the electric tension is stronger. When the latter is sufficiently elevated, any tree may be struck by lightning; but differences exist from the moment that the tension is feeble. The richness of the wood in water, contrary to what is generally believed, has no influence upon the conductivity of the living wood for the electric spark. On the contrary, such conductivity depends much upon the richness of the wood in starch and oil. Mr. Jonesco, in accordance with Mr. A. Fischer on this subject, consequently distinguishes trees as oil trees and starch trees, and reaches the following conclusions:

The green wood of trees is in all cases a bad conductor of electricity, and so much the worse in proportion as the tree is richer in oil. On the contrary, the green wood of amylaceous trees, poor in oil, conducts electricity relatively well. Living wood is a much better conductor than dead. This existence of dead branches in trees of both categories, therefore, increases the danger of lightning. This is an observation of no small importance from the standpoint of the safety of houses situated in the vicinity of large trees. The cambium and bark are better conductors than the wood, but these parts are relatively to the bulk of the tree, too slightly developed to modify its electric conductivity. The latter, therefore, depends upon the wood only, since, according to Mr. Jonesco, the foliage is equally without influence upon the relative conductive power of trees for the electric spark.

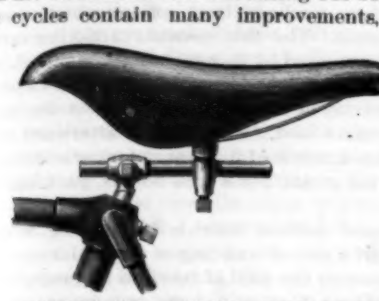
The results of these researches are confirmed in the statistics given by Mr. Jonesco, and which consist in the observations made upon lightning strokes and trees since 1847 by the superintendency of forests of the principality of Lippe. It has been found, for example, that the oak is much oftener struck than the beech. Now, the first is a type of starch tree and the second a type of oil tree. On another hand, the observations made establish the fact that the frequency of lightning strokes is greater in the dry than in the other branches. Besides, the same statistics go to prove that the danger of lightning has no relation with the character of the soil. Although the highest figures are shown in hard and sandy ground, this is due to the fact that starch trees grow in such soil, but the nature of the latter is without influence.—*Le Genie Civil.*

Explosion of a War Ship's Boiler.

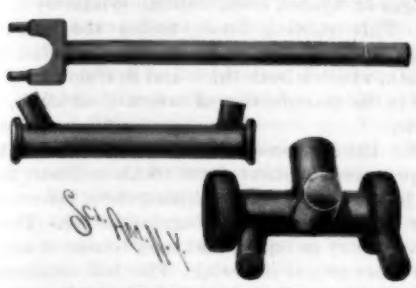
On the 16th of February an explosion of one of the new boilers of the German war ship Brandenburg took place in the harbor of Kiel. Forty men were killed and many wounded. The disaster took place during a test of the boiler. The Brandenburg is a steel belted cruiser, of 9,840 tons. Her dimensions are: Length, 354 feet 3 inches; beam, 64 feet. She draws 24 feet 7 inches of water. Her engines are of 9,500 indicated horse power, and she has a speed of 16 knots per hour. She was built at Wilhelmshaven in 1891.

THE LOVELL DIAMOND CYCLES.

In mechanical construction the Lovell diamond cycles of 1894 maintain the degree of excellence which has given them their well-earned reputation. The material used in constructing these cycles is all special stock, and by means of expensive testing machinery in their factory, they not only test all of their stock, but keep record of it from year to year. They use in their wheels the fewest joints and parts possible, and they have to-day fewer brazed joints than other wheels. The best English weldless steel tubes are used, and all connections are solid steel drop forgings. The ball races are easily removed and the balls are held in place by ball-retaining washers. The front and rear wheels are removable without taking out bolt or nut. These cycles contain many improvements, most of which are original mechanical devices, such as pedals, adjustable seat bar, absolutely dust proof bearings, high frame, and narrow tread.



SADDLE AND SLIDING SEAT POST.



SPECIAL DROP FORGINGS BEFORE FINISHING.

They are all finished in two coats of bright enamel, striped in gold, and highly polished; bright parts nickel-plated on copper and highly polished.

Their line of cycles covers track racer, weighing 19 lb.; road racer, 25 lb.; lady's wheel, 31 lb.; convertible, 31½ lb.; and light roadster, model 19, which we illustrate.

The wheels are 28 inches, having light crescent steel or wood rims as preferred. Full nickeled, tangent spokes of fine steel wire, swaged, are secured in the rims by nipples, and tied at the first crossing, making them very stiff and durable. The head is 10 inches long and made of one piece drop forging, with forged steel ball races at top and bottom. The forks are of the finest light steel tubing, brazed into a forged steel crown, which extends through the head and is one piece. Detachable mud guards and brakes are furnished, which can be easily removed if not wanted. Ball pedals, with square rubbers, light and dust proof. Rat-trap plates are furnished with each pair, which can be used in place of the rubbers. Adjustable dust proof ball bearings, of first quality throughout, including wheels, crank shaft, head, and pedals. This model is geared to 64 inches and weighs 32 lb., and when stripped, 29 lb.

LOVELL DIAMOND CYCLE—MODEL 19.

The saddle and sliding seat post shown is one of the new features for 1894. This enables the rider to regulate his position and brings him at proper place over the pedals, and, by turning a set nut at bottom of saddle post, the seat can be given any desired angle, either forward or back.

Among the new pieces of drop forgings made by their special machinery, we show the parts just as they come from the forging machines, and before they are finished. This enables the Lovell diamond to do away with many joints which other wheels possess, renders these cycles stronger and more durable, and shows to what perfection this branch of manufacture has been developed.

All interested in cycling should send to the John P. Lovell Arms Co., Boston, Mass., for one of their 1894 cycle catalogues.

The Manufacture of Aluminum.

In a lecture dealing with this subject lately delivered at a meeting of the Manchester Association of Engineers, Mr. W. S. Sample, of the Patricroft Magnesium and Aluminum Metal Company, said that the development of the electrolytic processes for making aluminum created a demand for pure alumina, and manufacturers had succeeded in supplying an article over 99 per cent pure, the 1 per cent being made up principally of water and silicon. Pure carbon electrodes were necessary, and these were furnished with a fraction of 1 per cent of ash. The result was that aluminum was made so that the entire product was over 99 per cent pure, which was much better than the regular results obtained by the chemical processes.

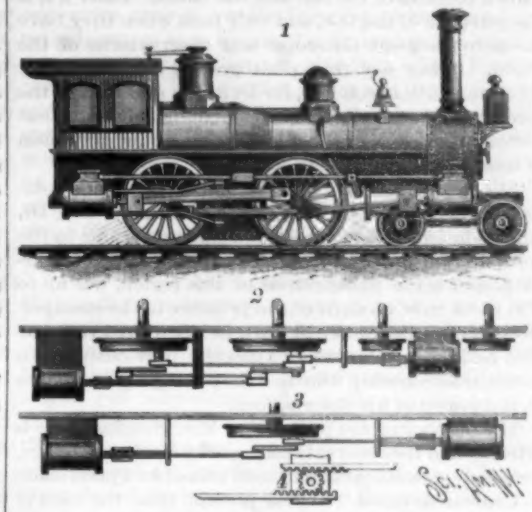
As the methods at present employed consisted of the direct reduction of the oxide of the metal, it did not seem possible to have a more simple process, and not probable that a more complicated compound could be treated in a more economical manner. It might be inferred, therefore, that further cheapening of aluminum would depend upon the greater consumption of the metal, and also upon cheaper power and materials, and the consequent decrease in the average general expenses with greater output. The present total output of pure aluminum was between 4 and 5 tons per day, which was more than the annual production up to 1886. This rapid increase in production had been due primarily to the decreased selling price, which encouraged consumers to make practical use of the metal. The present consumption might be graded into three classes, each of which took about equal parts. These were iron and steel, brass and bronze, and pure metal. The best testimonial was the continued use of the metal by both iron and steel makers, and brass and bronze founders. The properties of aluminum had been greatly exaggerated and as greatly depreciated by many writers. Notwithstanding the difficulties in perfecting a new process and in introducing a new metal, it had obtained a place among the metals of ordinary and daily use, and its position was continually being made more secure by a further appreciation of the uses to which it had been put successfully, and by new uses to which it was being applied almost daily.

Metallic Sodium on Water.

Even the amateur chemist knows that a bit of sodium dropped upon water produces an explosion. When a considerable quantity of the metal is placed in a partly closed vessel of water, a violent explosion occurs. It has been supposed that this is to be accounted for by the formation of sodium peroxide, which is at once decomposed, giving its oxygen to the hydrogen set free when the peroxide is made. Prof. Rosenfeld has been experimenting to find out whether or not this is the correct explanation of the phenomenon. He notices that the sodium is always blown to pieces from the center, and believes that the explosion is caused by the sudden separation of a hydride of sodium formed at the beginning of the reaction. He finds that a current of steam may be passed over a piece of sodium held in a bent iron tube without any explosion, and no oxygen can be detected in the resulting gas. The hydrogen is carried out of the tube before there has been time for the hydride to be formed. This experiment can best be performed with an iron crucible; the steam is blown into it through a side tube and the hydrogen escapes from a similar tube on the opposite side. When the steam is cut off, solid caustic soda, mixed with finely divided iron, is found in the crucible. This is thought to be due to the formation of an alloy of iron and sodium, which is afterward decomposed, leaving the particles of iron in the soda.

THE PATTERSON LOCOMOTIVE.

The improvement herewith represented consists in a change of method of applying power to driving wheels, and was patented by David S. Patterson, now deceased, of North Platte, Nebraska, June 6, 1893. Patents were also secured in Great Britain and Canada. Fig. 1 shows a standard American locomotive altered by application of the improved gear, and Fig. 2 is a plan view, by which it will be seen that power is applied to the same driving wheel from opposite directions, front and rear cylinders being connected by their rods to opposite ends of a double crank on the main driver. To preserve counterbalance and prevent pounding on the rear axle journals two side rods are used, the rear crank being of the same form as the main one. The engine deck forms the saddle for the rear cylinders, and has steam passages supplied through a pipe leading from the throttle pipe below the valve, the exhaust being carried under running board to rear of front saddle. In Fig. 3 the improvement is shown with only one driving wheel. The standard form of valve motion is used, the forward valve rod extending back to rear valves, its motion being reversed by the device shown in Fig. 4, contained in a covered box which also forms a guide for the rods. This arrangement is also adapted, without the side rods, to stationary engines, particularly those of high speed, where a heated journal would cause serious trouble, such as would be the case in an electric light or street car power engine. It is also adapted to English engines having a single pair of driving wheels. By thus applying the power from opposite directions it is designed to entirely eliminate pounding and friction in the axle journals, as well as to effect an entire freedom from the well-known "pound on the rail," for, as the rod leading to the forward cylinder will push or pound downward on the rail when its crank pin is on the lower quarter, the rod leading from the rear cylinder will be on the upper quarter, pushing upward with the same force as the forward rod has in its downward pressure. For further information relative to the improvement, address Letitia Shaw Patterson, North Platte, Neb.

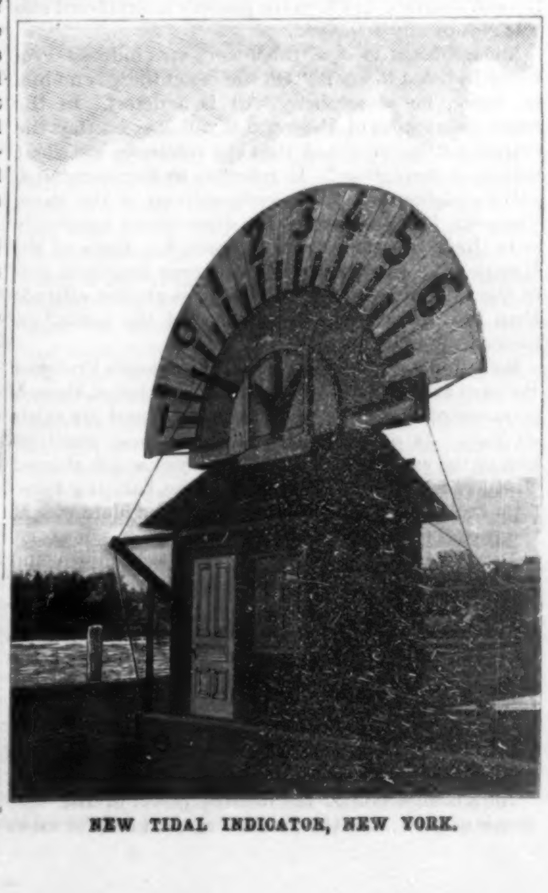


THE PATTERSON LOCOMOTIVE.

TIDAL INDICATOR, NEW YORK HARBOR.

Nearly all foreign trade vessels that enter the port of New York pass through what is termed "the Narrows," which is a contraction of the channelway formed by the bluffs of Staten Island on the one hand and Long Island on the other or easterly side.

For the convenience of mariners the government has lately erected upon the pier at Fort Hamilton a tidal indicator, to show, for the benefit of vessels passing in or out of the harbor, the condition of the tide. The arrow pointing downward shows that the tide is ebbing, while the mark under the figured dial indicates that it is almost dead low water and the flood will soon begin.



NEW TIDAL INDICATOR, NEW YORK.

Photographic Astronomy.

In course of a lecture at Golden Gate Hall, San Francisco, Jan. 18, on "Photographic Revelations in Astronomy," Prof. E. E. Barnard, of the Lick Observatory, said:

"Very few persons have seen any of the results of advanced astronomical photography, save the well-known pictures of the sun and the moon. Indeed, it is the privilege of the few, and only then when they have access to the great telescopes and observatories of the world. I may say that photography has practically revolutionized astronomy, for by its aid and that of the spectroscope we are enabled to see component suns that increase the power of the telescope on Mount Hamilton at least 25,000 times.

"As an illustration of the results of this class of photography, let me tell you that in February, 1892, Dr. Anderson announced that a new star was visible in the constellation of Orion. Professor Pickering, of Harvard, had made photographs of this region, but up to 1891 there were no signs of the presence of the stranger. However, on December 10, 1891, he discovered this star that had been recorded two months previously by an amateur astronomer, who used the photographic camera in the course of his observations.

"In October of the past year a Mrs. Fleming, who is interested in the observations made by Harvard College, detected a new star that had been affixed on a plate made in Central America. At the present time the rays of the sun have obscured this new star to such an extent that it is not visible, but the Harvard scientific party is still waiting at Arequipa to record its character when it emerges from the field in which it is at present bedimmed.

"Photography is also being applied to the discovery of other heavenly objects, and in the strange zone between Mars and Jupiter there are myriads of stars and kindred heavenly strangers that are constantly furnishing points of absorbing interest to those who study the field with the assistance of the camera.

"Last year, out of fifty discoveries, only one was made by the naked eye, and of the total number 35 were revealed to a single observer."

At this juncture Professor Barnard, with an assistant, used a stereopticon to illustrate the wonders and beauties of his subject, first showing the Lick Observatory in its shroud of snow, and again by moonlight and in a dense fog. He facetiously referred to his next picture as a lamp shade, but upon a closer study it was manifest to the audience that it was a faithful likeness of the sun as it sank on the crest of the ocean. Its eccentric form and luminous reflection gave it an apt resemblance to a transparent shade.

Again, the screen showed the sun with its spots and surrounding mass of incandescent hydrogen. The grouping of bright spots and granulated surface were distinctly defined and to the unscientific gave a bewildering insight to the dazzling surface of the orb of day.

"The heat of the sun is an unknown factor to scientists," said Professor Barnard. "According to their estimates it varies from 3,000 degrees to 180,000,000 degrees. One authority says that were the entire coal supply of Pennsylvania put within its radius, it would be consumed in the fraction of a second, while the glacial masses would be almost instantly turned to steam."

A photograph of the total eclipse of 1893, taken in South America, plainly showed the luminous corona of the great body. Then came the transit of Venus across the sun's surface, in which the planet's insignificant size was graphically displayed.

A magnificent view of the moon's area induced Professor Barnard to say: "On the moon there is no life, no water, no atmosphere. All is a desert. In the south pole region of the moon it will be seen that the craters are inactive and that the volcanoes are silent masses of desolation." In referring to the mountains, valleys, plains and other configurations of the moon Professor Barnard defined the distances as accurately as he would refer to the area between San Jose and Mt. Hamilton. "One mountain peak near the south pole of the moon is over 40,000 feet high—a greater altitude than that gained by any eminence of the earth," explained the professor.

Referring to the planet Mars and its canals Professor Barnard said that, in spite of repeated claims, there is no accepted theory as to whether intelligent life exists on Mars. As an illustration of the extreme sensitiveness of the camera a view was displayed which showed a projectile being discharged from the Zalinsky dynamite gun. Its flight when caught by the plate was at the rate of 600 feet a second.

A group of views of the Milky Way were shown and explained in a highly interesting manner. They were followed by a photograph of the double cluster of Perseus. It was remarked by Professor Barnard that the photographing of the comet of 1882, made at the Cape of Good Hope, was the real incentive for further research in astronomical lines by means of the camera. As illustrating the particular beauty of the skies, a view of the Pleiades, with their nebulous rims, was thrown on the screen.

As a comparison of the relative power of the telescopic camera and the human eye, a group of views plainly manifested the stupendous difference, and this was accompanied by a graphic showing of the Lick telescope traversing a starry field in search of astronomical phenomena. Professor Barnard gracefully concluded his edifying address by saying, "The heavens declare the glory of God and the firmament showeth His handiwork."

Relation of Heat to Electricity.

The effect of low temperature upon the physical properties of matter is very striking. For instance, it is found that the vigor of chemical action decreases and the elements apparently lose their ability to combine as their temperature is lowered. Thus phosphorus and oxygen, which so energetically combine at ordinary temperatures, become more and more chemically inert as this temperature is decreased, until at two hundred degrees below the freezing point of water they appear to be unable to unite. This may be otherwise stated by saying that in the absence of heat there is no chemical affinity. Now, heat is known to consist in the internal vibratory motion of atoms and molecules of matter, so that it appears that in the absence of such vibratory motions there is no possibility of chemical action. On the other hand, as the temperature falls the magnetic and electrical qualities of some, or all of the elements, is exalted in a proportional way. Thus, oxygen, which is feebly magnetic at ordinary temperature, becomes strongly magnetic at —two hundred degrees, and when liquefied, as it easily may be at such low temperature, it behaves like iron to a magnet, and will adhere strongly to its poles.

At ordinary temperatures copper is six times better a conductor of electricity than iron, but the conductivity of each is increased by cold. Copper is ten times better as a conductor of electricity at —one hundred degrees than it is at the freezing point of water, and the conductivity of iron increases at a still greater rate until iron becomes as good as copper. It has been proposed to inclose electric conductors in pipes to be kept very cold by some of the well known processes for extracting heat, such as are in common use for ice production, as the amount of copper needed would be less as the temperature was less. It may be some time before this plan is carried out, but that it is possible to thus reduce the cost of electrical conductivity by running an engine to produce cold is certain, and it will be done when the cost of copper becomes commercially comparable with the cost of running an engine for such a purpose.

Experiment seems to indicate that all the metals are thus affected by cold, and that at absolute zero their electrical conductivity becomes infinite, or, as it is more generally stated, the electrical resistance of metals becomes zero. The other properties of substances are also profoundly changed so as to be radically different from what they are under ordinary conditions; cohesion, tensile strength, malleability, etc., become less and less; so it seems altogether probable that the qualities and states of matter so familiar to us as solids, liquids, and gases depend absolutely upon temperature, and that at absolute zero there would be neither solid, nor liquid, nor gas, and that electrical and magnetic qualities would be at a maximum. This opens up a great field for speculation as to the nature of matter itself, when most of what we call its properties may be emptied out of it by simply reducing its vibratory motion. *—Prof. A. E. Dolbear, in the Cosmopolitan.*

Some Uses for Turf.

The following, according to the *Genie Civil* and the *Moniteur Scientifique*, are some industrial and economic uses to which turf has recently been put:

Manufacture of Alcohol.—Mr. J. Matheus has recently proposed, in *Dingler's Polytechnisches Journal*, to submit the substance to distillation in order to obtain alcohol from it. The base of the process consists in treating the turf with sulphuric acid of 30-35° B., derived as a residuum from certain industrial treatments.

The operation is performed in the following manner: The acid is added to the turf in sufficient quantity to obtain, with the water contained in the material, a 2·5 per cent solution of sulphuric acid. The turf and the acid are heated under pressure for five hours at a temperature of from 115° to 120° C. The solution thus obtained is separated from the insoluble residuum through a filtering press. The solution is then concentrated to a third and the acid eliminated through milk of lime and carbonate of lime. The solution thus obtained is cooled to 25° C., and made to ferment by means of yeast. Finally, the alcohol produced is distilled in the ordinary manner. On employing turf containing 14 per cent of water, 2,326 grammes of the material required 75 cubic centimeters of 20° B. sulphuric acid, and the volume of the mixture was about 1·5 liter. Three hundred grains of turf have, under these conditions, given 12·5 cubic centimeters of absolute alcohol.

Preparation of a Saccharine Liquor and of Alcohol.—Mr. C. Kappesser, of Karlsruhe, has taken out a patent (1) for the preparation of a saccharine liquor by boiling turf with acids, and (2) for the production of alcohol from the liquor thus obtained.

The turf is boiled with water mixed with sulphuric or hydrochloric acid, as in the usual process of converting cellulose into fermentable sugars. After the saccharification has reached its practical maximum, the liquor is filtered and then neutralized with chalk, and the sugar produced is isolated by the known processes (treatment with sulphurous acid, animal charcoal, concentration, etc.)

The liquor may also be directly fermented. The resulting alcohol is distilled in the usual manner.

Manufacture of Fabrics.—Mr. E. Beaumont, in the *Industrie Textile*, recommends a process of an entirely different order. He proposes to employ turf in the manufacture of fabrics, and that, too, without previous spinning. For the carrying out of his programme, he indicates four methods, from among which one has only to choose. The first consists in taking turf, obtained and prepared by any convenient method, in the state of fiber suitable for working, and in twisting it either by roving or rolling, so as to give it the appearance of a coarse cord. This rove is afterward woven, so as to form a fabric of it adapted for use as carpeting, jacketing for steam pipes and boilers, packing cloth, etc.

The second method consists in forming with the fibers of turf a sort of wadding of any thickness whatever, adapted to the kind of fabric to be produced, and then in quilting it so as to form squares or any kinds of designs or figures, even without symmetry or regularity. This quilting firmly unites the constituent fibers of the wadding and converts the latter into a true cloth, which is both thick and flexible and adapted for use in the manufacture of covers of all kinds, wrappers, etc.

In the third process, Mr. Beaumont submits the fibers prepared in sheet form to an ordinary felting, either just as they are or in mixing them before or after felting with some coating or agglutinative. This coating may be dry or liquid, and may consist of oil, gum, or any other proper material. The felt obtained may be afterward dried and passed through a drawing frame, or else be compressed or treated in any other manner. Blood, albumen, or any other analogous product may also be added to the fibers, so as to effect a coagulation at a certain degree of heat.

Finally, the last process consists in interposing between two or more layers of fibers a layer of some such material as paper or a tissue designed to give it more consistence.

Manufacture of Artificial Fuel.—Messrs. Strong & Gordon have taken out the following process of preparing briquettes of turf or other combustible:

Take 89 parts, by weight, of turf, 4 of cellulose, 6 of hydraulic lime, and 1 of rock salt, common salt, or sulphate of soda. Mix and make a paste with water and then mould in the form of briquettes.

Manufacture of Coke.—Mr. Franz Weeren, of Bisedorf, has taken out a patent for the manufacture of coke by means of turf, which consists in submitting the material to dry distillation and in grinding the resulting carbon with a suitable proportion of smith coal, and carbonizing the mixture. The product of the dry distillation of turf or of lignite is a sort of non-coherent dust that it is difficult to put to profit in this state. It is, therefore, mixed with from 15 to 100 per cent of smith coal (the proportions varying according to the nature and quality of these carbons), and the mixture is submitted to a second calcination. The tar disengaged by the coal serves to bind together the particles of dry carbon of turf or lignite and form a coke of good quality of them.

Use of Turf as a Horse Litter.—It is the mossy turf, chiefly derived from Holland, that is used for this purpose, although an exploitation of some extent, that of Pas-de-Jeu, is now carried on in France (see SCIENTIFIC AMERICAN SUPPLEMENT, No. 942, p. 15050).

Only the very fibrous, external layer of the deposits enters into its preparation. After it has been dried it must be divided. This division is effected by means of cutting disks mounted upon a horizontal cylinder. The turf is placed between two cylinders revolving with great velocity, and upon the distance apart of these depends the fineness or coarseness of the product obtained. The earthy substances are thus eliminated, and we have as a waste material a fixed dust called *torfmull*, which is much employed as a disinfectant for water closets.

The turf, torn apart and divided, falls into a compartment, wherein it is pressed, moulded, and bound automatically with wire, so as to form bales. In order to diminish the chances of fire as much as possible, the steam engine that actuates the apparatus is installed at a distance of 40 meters from the works. For the same reason, all the rooms are lighted with electricity. In order to reduce the expense of handling and carriage of the turf, a cutting apparatus is sometimes mounted upon a boat, which is easily moved to the places of exploitation where the mossy turf is found.

A TINY electric light fastened to the end of a pencil is a recent invention to enable reporters to make notes in darkness, and find the keyhole when they reach home.

THE THIRD AVENUE RAILROAD COMPANY'S NEW CABLE TRACTION PLANT.

The Third Avenue Railroad Company of this city for a number of months past has been engaged in constructing a cable traction plant for propelling cars over its main line running from the Post Office to the Harlem River, through Park Row, the Bowery and Third Avenue. The same company for a number of years has been operating with great success a cable line crossing the city at One Hundred and Twenty-fifth Street and thence running up town on Tenth Avenue. The main line, only now in full operation, represents the most recent improvements in cable traction, and its plant is in every way a model. We illustrate the Sixty-fifth Street driving plant and some minor features of the system.

The entire line is worked from two stations, one at the corner of Bayard Street and the Bowery, the other at Sixty-fifth Street and Third Avenue. The cable is divided into three divisions: The upper division runs from One Hundred and Twenty-ninth Street down to Sixty-sixth Street, crossing the other cable line at One Hundred and Twenty-fifth Street. Here the cars drop the cable and cross the other line by their own momentum. Reaching Sixty-sixth Street another change must be made to the middle division. The cable again is dropped, the car runs over the intervals between the two cables by its own momentum, comes to a stop and picks up the middle division cable. This cable draws it to a point between Sixth and Seventh Streets; up to this point the car has been driven at the rate of 9 miles an hour. Between Sixth and Seventh Streets the middle division cable is dropped and the lower division cable is picked up. This involves a reduction of speed to a rate of 6¼ miles an hour. Both the upper and middle division cables are driven from the Sixty-fifth Street station; the other cable is driven from Bayard Street. At Bayard Street another change is made. The main cable on the down town track is carried to one side and in its place an auxiliary cable running 5 miles an hour is substituted. The auxiliary and main cable then run down town and around a loop at the Post Office, the auxiliary cable being under the slot. Hence, when a car gets to Bayard Street it drops the main cable and picks up the auxiliary one, and then goes through Park Row and around the loop at the end of the line at the rate of 5 miles an hour. After running a few hundred feet on the return, the car drops the auxiliary cable, which then runs to one side, and picks up the regular cable and continues its journey at the rate of 6¼ miles, changing the cable and its speed to 9 miles an hour at Sixth Street, and changing to the upper division cable at Sixty-sixth Street.

Throughout the conduit lies a duplicate inactive cable on independent sheaves following a line parallel with the operating cable, which duplicate cable can be driven when required by an entirely independent driving plant, an exact duplicate of the working one. The car grip is two-sided, and without any change is adapted to pick up and retain either cable; hence, if any accident happens, the duplicate plant is instantly started in operation. The duplication is so complete that neither plant can be distinguished from the other in any respect, and the entire reserve cable operates as the regular one.

The traction cables are 1¼ inches in diameter, 6 stranded, with 19 wires in each strand and with a hemp core. They are made of crucible steel and weigh 3·65 pounds per foot. The cars, which are built by the Laclede Car Company, of St. Louis, Mo., are 30 feet 1 inch over all, weigh 5 tons and have a seating capacity for 32 passengers. One hundred and eighty cars will eventually be run upon the line.

The grip is slung by the dovetailed ends of the upper bar from two boxes carried by the axles. To remove it from a car it can be dropped bodily from its place, or a trap in the floor of the car can be opened and the grip can be lifted bodily through that. It weighs 450 pounds and can be handled by four men. The grip is operated by a lever, so that an inspector can tell at a glance whether the grip is in action or not. For picking up and releasing the cable an auxiliary lever is employed, which extends the range of action of the grip, which extension of range is necessary during the picking up or dropping of a cable. To throw the cable out of the grip a wedge-shaped piece seen at the bottom of the grip on the end facing the reader is drawn upward; its inclined face pushes its rope to one side and out of the grip.

The cars are provided with life guards carried by the journal boxes of the wheels and hence holding an invariable level as referred to the pavement. The guard is faced with rubber, set so as to come in contact with the pavement, and it eventually wears to the surface. The life guard is so far under the car that the gripman has an extra space in which to stop the car before the life guard touches any one prostrate on the track.

The boiler plant in the Sixty-fifth Street station contains thirty-two 125 horse power boilers. They are of the double return horizontal tubular pattern, each containing ninety-two 3 inch tubes. They are arranged in batteries of four. Their shells are 6 feet in diameter and 18 feet long and they maintain a steam pressure of 90 pounds to the square inch. Four 1,500 horse power Corliss engines, with 40×72 inch cylinders, are arranged to drive the machinery. The engines make 65 revolutions per minute. Their power is transferred to the cable driving plant by means of rope belting, which is one of the striking features of the plant, and is well shown in our cuts. On each drive wheel 22 endless cotton ropes 2¼ inches in diameter are employed. By friction clutches the power can be shifted about in any desired way from engines to drums and driving wheels.

The cable, as it enters the house, passes a number of times around two grooved pulleys, seen in the foreground of the drawing of the Power House Interior. The bar connecting the shafts of these wheels is adjustable, so as to regulate their distance apart. A tension railroad with a range of some 200 feet keeps the cable stretched, and is calculated to be of sufficient extent to take up all the stretch that may affect the cable during its entire lifetime. A 30 ton Sellers steam crane surmounts the power house and travels from front to rear, thus giving every facility for handling parts of the machinery. The plant was erected by the Pennsylvania Iron Works Company.

It is of course possible that a gripman might neglect to drop the cable at the proper place, and hence cause an accident. To prevent this danger automatic mechanism is introduced in the conduit wherever the cable is to be dropped, which mechanism actuated by the weight of the car throws up a bar of iron, which releases the cable if the gripman has neglected to do so; if he has re-leased the cable, the bar is thrown up but does not affect the grip mechanism.

It is impossible in our space to describe all the features of this plant. Minor details are introduced at all points, affecting in no small degree the perfection of the whole. The plant is installed in the rear of the old building. The latter it is proposed to replace by a new one at an early date. One feature of the line is that no horses are used at points where the cables are changed.

Our thanks are due to Mr. J. H. Robertson, superintendent of the Third Avenue Railroad, and Mr. C. G. Bliss, chief engineer of the operating department.

The Fire Alarm.

"One of the greatest difficulties the firemen have to contend with is the fact that fires are allowed to gain too much headway before they are informed of them," said Chief Bonner the other day to a New York *Sun* reporter. "The reason for this is that the average citizen has not had the good sense to take a few necessary and simple precautions. When a fire does break out in his house he is caught totally unprepared, and, in nine cases out of ten, loses his head and tries to extinguish it himself, without giving a thought to the fact that such things as firemen exist. After wasting valuable time without accomplishing any good, he is finally forced to give up his task, and then calls on the firemen. Of course, it takes him considerable time to do even this, as he is probably unaware of the location of the fire alarm box, and when he does find it is ignorant as to its workings.

"We calculate time by seconds in the case of alarms, and it is the duty of every citizen to co-operate with us. If he did so there would be small chance of any loss of life with the modern life-saving apparatus where we get a chance to use it. Now, I don't mean to say that an alarm should be sent in at a sign of smoke or flame, or on suspicion that there is a fire lurking in the house, but a little common sense with quick judgment will do. In the first place, everybody should be prepared for fire at all times. The citizen should inform himself and family of the nearest fire alarm box to his home or store, and ascertain where to find the key and also how to give the alarm. This is an easy matter. The location of the key is to be found on a sign on the pole to which the fire alarm box is attached. Any reputable citizen can obtain a key by making application to the commanding officer of the fire company nearest his location. Some fire alarm boxes have keys attached to a chain and tag and fastened to the box, so that they are ready for use in a moment. Of course the department takes the risk of false alarms in such cases, and the presence of the key depends largely on the locality. The penalty for sending in a false alarm is $500 or a term of imprisonment, and it is enforced where the culprit is caught and can be convicted.

"In order to show you just how to send in an alarm, so that there can be no error, the boxes have instructions printed, so that he who runs may read. After opening the outer door another door is disclosed, which has a hook on the outside. This hook should be pulled down as far as it will go, only once. This hook catches a lever on the inside and winds the machinery. You can plainly hear the tapping of the signal inside, and if you should not hear it after a second trial, why, the box is out of order, and the next nearest box should be tried. The keyless boxes have an alarm gong connected with the handle, which rings just as soon as the handle is moved. This does not send the alarm, as many persons suppose, but is just used to attract attention to anybody tampering with the box mischievously. To open a keyless box the handle should be turned to the right as far as possible, and then the inner door will be exposed and the alarm can be sent in as in the case of boxes with keys.

"Supposing that the person who sends the alarm should be required to leave the box before the first fire apparatus arrives, somebody ought to be asked to remain there, so as to inform the firemen of the exact location, as the box does not give that. The Fire Department should be notified of fire as early as possible, and then every means at hand should be used to extinguish or prevent the fire from spreading. Where water is used, as much surface of the fire as possible should be covered, and it also should be remembered that a small quantity of water judiciously distributed will stop a small fire quicker than a larger quantity thrown in one spot.

"A fire in the night is necessarily more dangerous than a day fire, because it generally gets a good hold before it is discovered, and paralyzes the senses of the persons in the house for the moment. If you should be awakened by fire and feel a sense of suffocation by smoke, you may obtain relief to some extent by lying flat on your stomach and holding the face close to the floor. Smoke and hot air ascend, and the coolest and freshest air is found nearest the floor. The windows should be lowered from the top and raised from the bottom, so as to allow accumulated smoke to escape from the rooms. A piece of silk or woolen cloth held over the mouth and nose will prevent suffocation for a short time, especially if it is wet or dampened.

"Persons should not waste any time by attempting to dress or in endeavoring to save anything. The simplest thing to do is to just wrap your blanket around you and get out the quickest way possible. The doors should kept closed, so that all draughts are prevented. One should bear in mind that blankets and sheets knotted together and fastened to any permanent fixture are a very effective means of escape. If all means of escape are cut off, the person in danger should try to retain presence of mind. There are few places in the city that cannot be reached in from one to four minutes at the most by fire apparatus, and, as all carry life-saving implements, it is but the work of a few seconds to get them in position. In the event of a person's clothing taking fire where help is at hand, the victim should be placed in a horizontal position at once and wrapped up in anything that will exclude the air. Women and children are more liable to suffer in this way than anybody else, and especial care should be taken in that case.

"The clothing of the person attacked by fire ought to be removed immediately after the flames are extinguished, and the injured parts bathed with linseed or sweet oil.

"The records of the department show that fires are caused principally by careless workmen, foul chimneys, defective flues, gas jets, fireworks, hot ashes, accumulation of rubbish, overheated furnaces and stoves, children and matches, electric light wires, and kerosene lamps or stoves. The department has recognized the inattention of most persons to keep themselves informed about fires, and highly colored cards are distributed which give the location of the nearest alarm box and instructions for sending in alarms. Persons are also cautioned to see that their stoves, heaters, lights, matches, and ashes are secure before closing up their stores or before retiring. A few minutes' thought will suffice for anybody who wants to be prepared, and it should be remembered that forewarned is forearmed."

The Therapeutics of Oxygen.

Dr. A. W. Catlin, of Brooklyn, in a paper read before the Medical Society of the State of New York, recently held in Albany, stated that the therapeutic use of oxygen was of very recent date. The treatment of disease by natural means was proving more and more efficacious as experience increased. Oxygen was a distinct remedial agent—one that should not be left untried until the patient was *in extremis*. It was the surest and most satisfactory stimulant that we possessed, and was applicable to many conditions. In profound shock, from whatever cause, it had been found to exercise a reviving effect. It was taken up quickly by the blood, but its chief value was in its effect upon the nerve centers, upon which it exercised a quieting and soothing effect. In hemorrhage from typhoid fever he had seen relief in many cases. It would produce sleep, favor assimilation, and shorten the period of convalescence of typhoid fever. No agent was so well tolerated or so useful in restoring the equipoise of the physical condition. In cases of childbirth, pneumonia, bronchitis, and other exhausting diseases, the use of oxygen was indicated, and it should not be given late, but early.

PROF. LANGLEY demonstrates that if a body of coal sufficiently large to last the United States a thousand years should be set on fire, the heat given forth from it would not equal that which the sun gives out in the thousandth part of a second.

THE GALVESTON (TEXAS) STEEL WAGON BRIDGE.

The great steel wagon bridge of Galveston, Texas, which connects the island of Galveston with the mainland of Texas, has recently been completed.

The bridge is notable not only for its great length, but for the economy of construction and the rapidity with which it was built and finished.

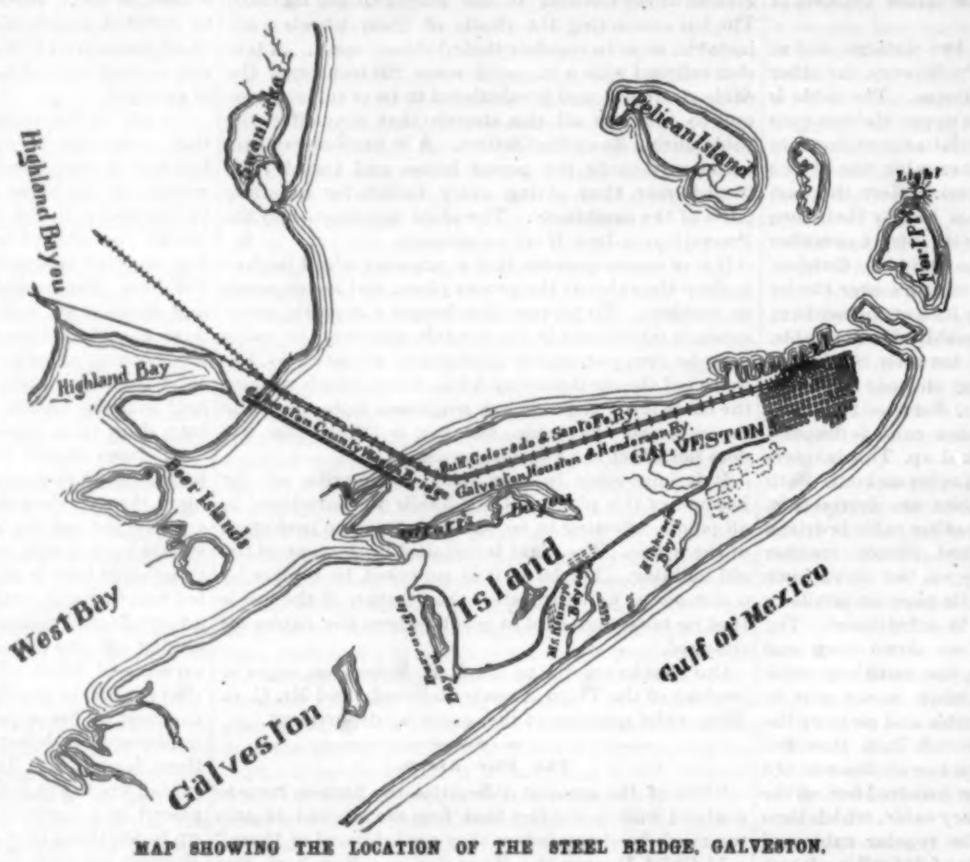
We are indebted to Mr. H. C. Ripley, C.E., under whose immediate direction this excellent work was done, for the following particulars, and to Mr. Chester Haile for photographs.

The contract was let to Mr. A. J. Tullock, proprietor of the Missouri Valley Bridge and Iron Works, of Leavenworth, Kansas, to construct the bridge complete for the sum of $182,500. Afterward some extension of the trestle approach and extras brought the total cost up to $191,896.75.

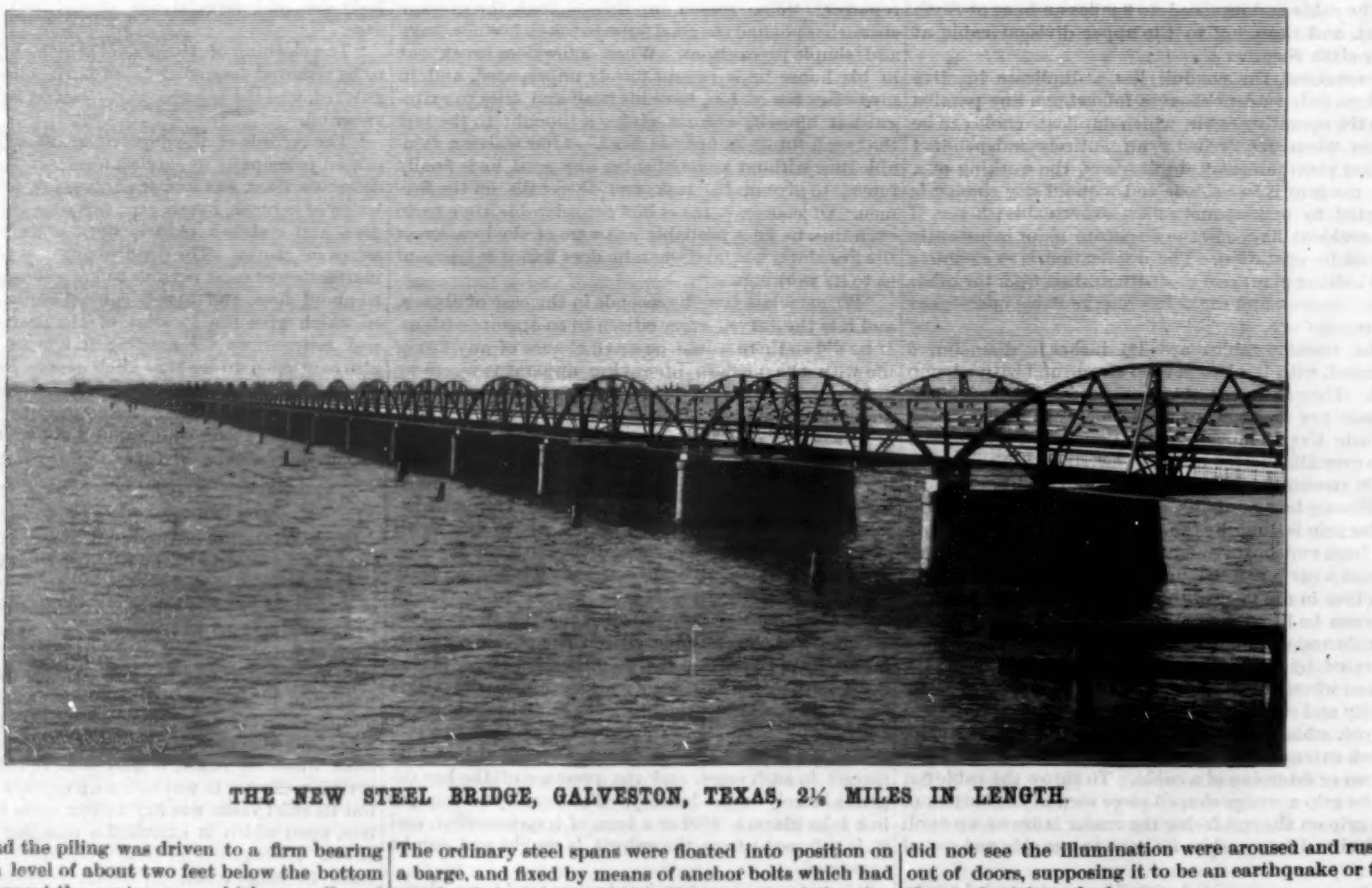
The accompanying map shows the location of the bridge. We also give an engraving, from a photograph, showing the general appearance of the superstructure.

The bridge consists of 89 fixed spans 81 feet long and one draw span 226¼ feet long, of steel, resting upon 92 concrete piers, making a length of steel structure of 7,432½ feet, and 3,877 feet of pile trestle approach, which added to the steel structure gives a total length of 11,309½ feet. The elevation of the floor is 13 7/12 feet above the plane of mean low tide. The piers rest upon a pile foundation, with or without grillage, which was constructed in the following manner: An iron caisson extending from the bottom to the water surface, and somewhat larger than the base of the pier, was first put down at the site of the proposed pier and the material of the bottom dredged out to a depth of two or more feet, and, if hard bottom were found at that depth, no grillage was used, and the piling was driven to a firm bearing at a uniform level of about two feet below the bottom of the bay, except the center row, which was allowed to project five feet above the rest, and which extended into the mass of concrete comprising the pier. Where the nature of the bottom was such that too much dredging was required to reach solid bottom, a grillage was used which was composed of pine timber twelve inches thick (made in two layers of six inches each, the pieces in each layer being placed at right angles to each other and drift-bolted together) placed on top of the piling, which in this case were all driven to uniform level. The number of piles used for the foundation of the ordinary pier varied from 17 to 24. The pivot pier, which supports the draw, rests upon 63 piles. The mould for the pier was then placed in position and filled with concrete. This mould was in two sections, the first extending just above the water surface and the second to the top of the pier. The second section was not placed until the first section had been filled. Where grillage was used the first section of the mould was fastened to the grillage by means of wood screws and could be released when the concrete had become set and sufficiently hardened to permit its removal without injury to the pier.

The concrete was composed of imported Portland cement (Gillingham brand), good, sharp sand, and a good quality of broken sandstone, in proportions of one of cement, three of sand, and five of broken stone.



MAP SHOWING THE LOCATION OF THE STEEL BRIDGE, GALVESTON.



THE NEW STEEL BRIDGE, GALVESTON, TEXAS, 2¼ MILES IN LENGTH.

The ordinary steel spans were floated into position on a barge, and fixed by means of anchor bolts which had previously been embedded in the concrete of the pier. The draw span was erected in position.

The trestle approach, where exposed to teredo action, was built with creosoted piling. Where it was not so exposed, cedar piling was used.

The center or pivot pier is 21 feet in diameter at the top and has a batter of ½ inch to the foot. It is octagonal in plan. The other piers are 3 feet wide across the top surface or coping and 23 feet long on the same surface. The coping projects over the main body of the pier 3 inches in all directions, so that these piers at their narrowest points under the coping are 2½ feet in thickness and 22½ feet in length. The ends are circular in form, and both sides and ends have a batter of ½ inch to the foot. The draw is operated by means of gearing. The pinion is attached to the draw and works in the spur, which is attached to the pier and is worked by a crank located in the watchman's house above.

The approximate cost of the work in detail was as follows: Cedar pile approach, $6 per linear foot; creosoted pile approach, $6.75 per linear foot; steel spans, including foundations, $15 per cubic yard.

A Remarkable Meteor at Candelaria, Nevada.

Mr. F. Corkell, writing to the *Mining and Scientific Press*, says: On the night of Feb. 1, at 10:7 o'clock a brilliant meteor appeared, coming from the southwest. It made a tremendous illumination, suddenly, as if a great flash light were thrown in well-lighted rooms, wherever a corner of window curtain or shade was not tightly drawn. So intense was it in brilliancy that those who were out of doors were dazed, and but a few could tell whence it came or whither it went. It was of a dazzling electric blue, like many are lights had suddenly shot into existence. The illumination lasted about four seconds, disappearing in the northeast. The illumination brought all who were awake to their doors, awe-stricken, thinking some slumbering crater had burst into flame.

Thirty seconds later a terrific explosion occurred, like tons of dynamite suddenly exploded, shaking the hills and echoing through the rocky caverns.

It was like a huge bombshell had been hurled in our midst. There followed a boiling and sizzling roar, like an immense mass of red hot iron cooling in water. The sound grew fainter and gradually died away. This lasted about fifteen seconds.

Those who were sleeping and did not see the illumination were aroused and rushed out of doors, supposing it to be an earthquake or that the crack of doom had come.

When the snow melts and the focus of the explosion is definitely located, a search will be made for the meteorite.

None who saw or heard this meteor will forget it, and they will relate it in future years as a great event; nor will any one here desire to be nearer to those celestial bombs than he was this night. Some ducked their heads to let it go by and considered it a very close shot for a star.

EVERY pontoon used in the French army weighs 1,658 pounds and has a buoyancy of 18,675 pounds.

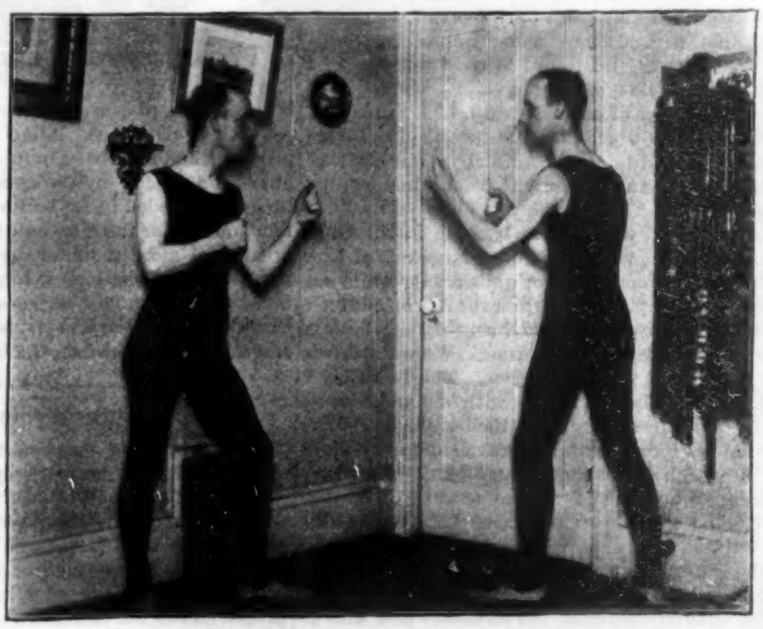
ILLUSIVE PHOTOGRAPHY.

We illustrate some most amusing examples of illusive photography, which are reproduced from some photographs sent us by Mr. Frank A. Gilmore, of Auburn, R. I. Mr. Gilmore does not feel satisfied with representing the human form divine in a single role, he wishes to show on one plate the same person the giver and recipient of a "tip," or both on the offense and defense in a "bare knuckle" fight. If a person is to be photographed in the street, he is given himself for company. Our illustrations tell their own story. The porter with his sack and the gentleman about to give him some money are one and the same; the pedestrian is in the company of his best friend, himself; and the fighter is prepared to annihilate himself. The photographs from which these were reproduced are of excellent quality, and are most interesting.

The method of producing them is very simple. A black-lined box is fitted to the front of a kodak, or any form of camera. The front of the box is closed by two doors. On opening one door a picture may be taken on one side of the plate; on closing this door and opening the other, the other half of the plate is ready for exposure.

The subject poses in one position and is photographed with one door open, care being taken to bring the figure within the proper area of the negative. The finder enables this detail to be attended to. Then the door is closed, the other is opened and the second exposure for the other half of the plate is made with the subject in the other position. It is not necessary to touch the plate holder between the exposures. The cover is withdrawn, the one door is opened and the shutter is sprung. The doors are then changed and the shutter is sprung a second time. Time exposures are rather risky, as involving danger of shaking.

These views were taken with an ordinary four by five inch kodak, and the box was an ordinary cigar box cut down to fit, and blackened inside.

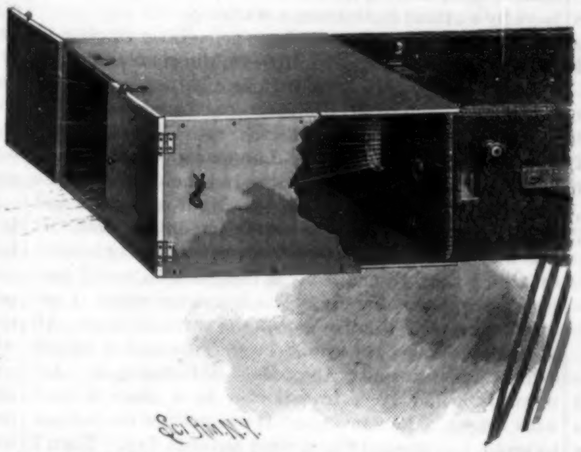


DUPLEX PHOTOGRAPHY—SHOWING TWO PHOTOGRAPHS OF SAME PERSON ON A SINGLE NEGATIVE.

Electrical Wonders and Anticipations.

It is not an extravagant statement to say that never before in the history of the world has there been a scientific discovery about which centered such magnificent dreams as are being built up on certain recently discovered electrical principles. Among these the foremost place must be given to the astounding discoveries of the young Servian genius, Nikola Tesla, which are so novel and so extraordinary that the most imaginative of inventors are unable to foresee what form their development will take. Just as experimenters were beginning to think that they knew all that could be learned about electricity, and that further improvement must be in the line of more perfect mechanical application, Mr. Tesla shows us the electric fluid under conditions in which it differs from ordinary electricity as much as light differs from heat. A current of 2,000 volts will kill a man in the twinkling of an eye, but this modern wizard lets currents pour through his hands with a potential of 200,000 volts, vibrating a million times a second and showering from him in dazzling streams of light. For some time after the experiment ceases his body and clothing emit streams and halos of splintered light.

The wildest dream of the inventor could not have



ATTACHMENT TO KODAK FOR DUPLEX PHOTOGRAPHY.

foreseen that while currents of low frequency are deadly, these are harmless. Mr. Tesla says that he will soon be able to wrap himself in a complete sheet of electric fire that will keep a man warm at the North Pole without harming him. Neither Merlin nor Michael Scott nor any of the wizards of old ever wrought a more potent miracle, even in fancy. The meaning of this is too far beyond us to be realized at present. We can no more grasp its significance than Franklin could discern the electric motor in his captured thunderbolt. Equally astounding, and with more visible usefulness, is Mr. Tesla's discovery that currents of such enormous potential and frequency can be transmitted without the use of wires. A room can be filled with electricity from copper plates in ceiling and floor, so that electric lamps will burn without any connecting wires as soon as they are brought in. In the same way intelligence and power may be transmitted without a circuit, doing away with the necessity for trolleys, storage batteries, and subways. When it is considered that such startling changes as this are already theoretically possible, it will be seen that in the inventions upon which we so complacently congratulate ourselves we have only timidly paddled along the shore of the great sea yet to be explored.

This sudden enlargement of the ideas of scientific men in regard to the nature and the possibilities of electricity has led the New York *Mail and Express* to bring together in a symposium the opinions of well-known electricians as to the future developments of electrical science. Mr. Edison thinks we shall yet be able to get electricity direct from coal—a discovery compared with which the philosopher's stone is a bauble. Then our steamships will need only "a snug little bin for 250 tons of coal instead of one for 2,800 tons." Successful aerial flight, electric cookery, a transatlantic telephone, a real telescope with which one can see around the world by the medium of a wire, the formation of wholesome food products under the potency of electrical affinities—these are some of the things which imaginative inventors foresee. Most startling of all, though it was suggested nearly ten years ago by an undergraduate in a Western college, is Mr. Edison's idea that unspoken thought may be recorded by electrical apparatus applied to the cranium, and either reproduced at pleasure or transmitted to another person.—*Springfield Republican.*

New High-Speed Cruisers.

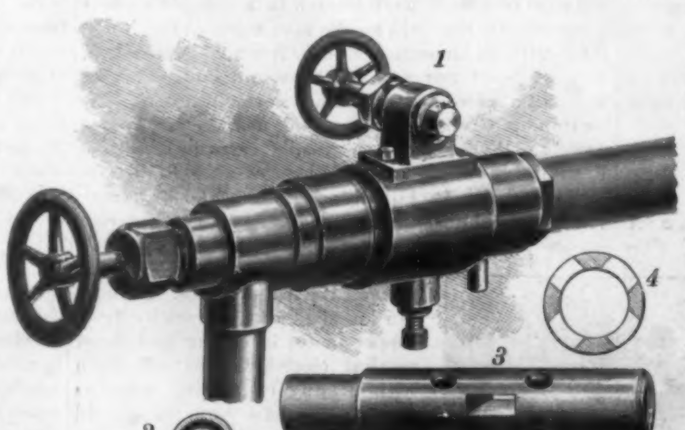
The British Admiralty have given out orders to the Naval Construction and Armaments Co., Barrow, and Messrs. James and George Thomson, Clydebank, Glasgow, for the construction of two high-speed cruisers for the British navy, to be named the Powerful and Terrible respectively. These two cruisers are each to be about 500 ft. long, and will therefore be the longest afloat. They will conform more to the type of Atlantic liners, and will have great coal endurance. They are to have an armored deck, which alone is to afford protection, except that the coal will be so arranged as to assist to this end. Speed is to be the first consideration, hence the great length. The principal novelty is the use of the water-tube boiler for the first time in a high-speed cruiser. It is not improbable that the boiler adopted will be the French Belleville type, although the details are not yet irrevocably determined. This boiler is the one which has been most extensively tried in vessels, but in Britain there is no experience of it. It is, however, being fitted to 22 cruisers or battleships ranging up to 14,000 indicated horse power in six Russian vessels; while the Messageries Maritimes has fitted it to seven vessels, in some of which it has been worked satisfactorily for ten years. It has been tried also in other navies, but not in any case in large cruisers, which are to attain a speed of 23 knots, as in the cases of the Powerful and Terrible.

Arctic Geology.

According to Sir Henry Howorth, the Arctic lands, during the Pleistocene period, instead of being overwhelmed by a glacial climate, were under comparatively mild conditions. Since Pleistocene times the climate has been growing more and more severe. The author bases this conclusion on a study of the Arctic flora as displayed in Greenland, Spitzbergen, and the uncovered moraine of the great glacier in Alaska, and also upon certain faunal facts. He cites evidence to show that the present flora of Greenland is undoubtedly a relic of an old flora which has survived in favorable localities, and not an importation since glacial times. The same is true of the Spitzbergen flora. The discovery of a colony of sea cows on Behring's Island seems to indicate a recently milder climate in that region. The peculiar types of northern migratory birds suggests that at no very remote period they lived the year round in their present breeding places in Northern Siberia, Greenland and Spitzbergen, and that it is the present ever-increasing cold that leads them to migrate in search of warmth and food. In short, the only glacial climate we are warranted in supposing to exist in the Arctic lands is that which is now current, and it is the product of changes in the level of the earth's crust since Pleistocene times.—*Geol. Mag.*

AN IMPROVED ENGINE GOVERNOR.

This is a governor through which the steam passes on its way to the engine, and the speed of the engine is thereby regulated to a nicety by its control of the steam supply, without using any gearing or exterior mechanism. The improvement has been patented by Mr. William H. Watson, of No. 6 North Peters Street, Jackson Square, New Orleans, La. Fig. 1 represents the application of the device, Fig. 2 being a sectional view. The governor comprises an elongated casing, for convenience made in two parts, screwed together, through which the steam flows to the engine, the casing being internally thickened on opposite sides of its center, and affording steam-tight bearings for a sliding regulating piston, shown in Fig. 3. The piston has at its opposite ends the cylindrical chambers, A B, independent of each other, and connected by means of ports and a central chamber in the casing, as indicated by the arrows, Fig. 4 being a cross section of one set of ports. The chamber B is of somewhat larger diameter than chamber A, affording ready passage for the steam, and consequently, when the engine is working easy, the piston slides in one direction, but when the engine is working hard, the back pressure moves the piston in the opposite direction, thus closing and opening the steam supply. The exit end of chamber B is beveled, and by changing the pitch of the bevel the chamber may be made to discharge the steam more or less easily, and the inlet end of the piston is reduced and held in a bushing, forming a chamber from which leads a vent pipe, C, thus forming an air cushion which gives the piston an easy and steady motion. Opposite the outlet end of chamber B is arranged a percussion plate, against which the piston moves to shut off the flow of steam, the plate being held in a chamber in the outlet of the governor, and the end of the plate toward the piston being preferably concave. The plate is carried on the threaded end of a spindle, which projects through a stuffing box, and has on its outer end a hand wheel by which the plate may be nicely adjusted to permit the right throw of the piston, which is moved back and forth automatically by the shifting steam pressure. If the piston should ever stick from rust or other cause, it may be moved by hand to limber it up by means of an arm projecting through a slot in the center of the piston, a screw secured in a plug in the casing entering the opposite side of the slot. The arm is carried by a shaft provided with a hand wheel, by turning which the piston may be slipped back and forth in the casing. The invention also provides different means, more particularly adapted for locomotive use, for moving the piston by hand.



WATSON'S STEAM ENGINE GOVERNOR.

Sensations of Drowning.

To stand helplessly on the river shore and witness the struggles of a drowning fellow-being is a harrowing experience, and little less heartrending to contemplate, but, in matters of this kind, like many others, "things are not what they seem." At any rate, death by drowning is not as horrible as it may seem to the onlooker. The thought of being dragged along the muddy bottom of the river and found later in some out-of-the-way, willow-tangled spot is what adds to the horrors of such a death. The dread of such a fate is really worse than the fate itself. I once left this world by that route as nearly as one can and get back. It was an accident, and was some twenty years ago.

A companion and myself were bathing in the Ohio River. At the point where we were a large raft of logs was lashed to the bank, and for quite a long while we amused ourselves by jumping from the raft into fifteen feet of water to see who could bring up the largest number of white gravels each time. We went down several times with varying success. The last time I made the effort I filled my lungs with air and leaped far out into the river and went to the bottom head first. I groped about for a handful of gravels and spent more time in the search than I should have done. The water was warm, however, and I had no fears of drowning. When I could stay down no longer I started swiftly for the surface, and when within a foot or two of the top of the water my companion, not knowing exactly where I was, jumped headlong into the river. His head struck me squarely between the shoulders and knocked the last ounce of air out of my lungs, and a deluge of water at once took its place. The weight of his body falling on me produced a terrible shock, and I sank to the bottom of the river like a stone. That is where I got my experience in drowning. When the water rushed into my lungs and stomach it felt for all the world like a pleurisy pain, which has also given me a tussle in later years, but was over in a second. Then my body settled quietly to the bottom and my arms fell limp at my side.

In my half-conscious condition I could see all my relatives and acquaintances crowding about and looking down on me with tearful faces. All the events, it seemed, of my prosy career passed slowly in review, and the good, bad, and indifferent acts stood out before me in bold relief. Even little school boy tricks claimed attention. I knew I was drowning and remember thinking, "Why, this is not so hard after all!" I wondered where my body would be found, and shuddered at the thought that it might never be found. I also wondered whether or not my companion had become alarmed and run away and left me to my fate, or whether he was diving here and there to find me. Then I pictured my burial, and how the clods would resound on my coffin when it was lowered into the chilly grave, and my fate would be pointed out to other boys by anxious mothers as a warning.

At the next stage I could hear bells softly ringing in the distance, together with little tinklings and chirrups sounding in my ears. Then I began to see pretty pictures. The colors of the rainbow danced before my eyes and intermingled and formed into all sorts of odd shapes. I had no pain and no fear of what was expected to follow. I seemed to be enchanted at the scene before me. Everything was light and calm and moved about without any visible impelling force. It was like looking into a large mirror with every beautiful thing that the most vivid imagination could conjure up revealed thereby. The last stage which I entered increased the beauty of the surroundings. All discordant noises ceased and were superseded by the softest, sweetest music that could be thought of. Apparently I had been transported to a place flooded with bright, calm sunshine. It was neither too hot nor too cold, but seemed like a clear autumn day. Then I seemed to rise from the ground and float off into space like thistle down. Higher and higher I went until I seemed to look down on the world from a great height, and then came a blank. The next thing I knew I was lying on the raft with my companion looking down on me with a pale face. After several unsuccessful attemps he had succeeded in finding me and getting me out of the water. By vigorously rolling me over a log he had succeeded in rekindling the spark of life that remained. For the next half hour I think I suffered a great deal more than for the same length of time before or since. I shall never forget how it feels to drown, but would not advise any one to try it to find out for himself. Resuscitation is too painful.—*Mr. C. A. Hartley, in the Cincinnati Times-Star.*

The Useful Arts.

A knowledge of many useful arts is essential to the existence of man, nor is it easy to imagine the possible existence of any race, or even tribe, totally ignorant of the useful arts. On the other hand, to perceive the absolute truth and to represent this in marble or on canvas, to place before the eyes of men correct imitations of what nature has created, is the highest of gifts. In proportion as the individual or race gives a preference to the objects invented by mankind over nature's creations, so will the taste of that individual or race be low, unintellectual and remote from truth; his sympathies with the living world have been thrust into the background by the mathematical and logical inventions of human nature; he traces all to utility, the goddess he worships, and boldly proclaims that nature herself in her inventions had utility in view. Without being aware of it he worships human reason, and denies that anything exists beyond it. By carefully noting the artistic efforts of a race, we may arrive at a tolerably clear idea of the view that race took of the external world. Now in that view are included the character and nature of the civilization of the race.

Artesian Wells in Dakota.

Work has been quietly going on in South Dakota for the past year which seems to prove that the artesian wells of the James River valley are as valuable and reliable a kind of water power as could be wished, and from all indications will continue to be so for years to come. Already a number of electric light and flour mill plants have been installed, and are in daily operation.

The artesian well district of South Dakota is located in the valley of the James River, covering a tract about 40 miles wide and 200 miles long. The James River is about half way between the Missouri and the eastern boundary of the State. The water-bearing rock is found at from 900 to 1,000 feet from the surface. The first and most vital question that comes up is as to whether the supply is reliable, and can be depended on to continue with its present pressure, as more wells are sunk and a greater volume of water is drawn from the underground source.

There are good reasons for thinking that the supply is practically inexhaustible. These reasons are based both on the theories advanced by the United States government geologists and on observed facts in connection with the sinking of wells. The government theory is founded on the fact that the same stratum in which the water is found outcrops in the beds of the upper Missouri and Yellowstone Rivers and at the base of the Rocky Mountains. The water, sinking in this porous stratum of rock, follows it for hundreds of miles, until tapped by the South Dakota wells. It has long been believed that there is more water in the Missouri River above the Great Falls than there is 30 miles below. For 25 or 30 miles below the falls the river bed is composed of the same sand formation in which the South Dakota wells get their water. If this theory is correct, as it probably is, the supply of water to these wells may be looked upon as inexhaustible—at least as much so as the sources of our Rocky Mountain streams. Another fact that would point strongly to the truth of this theory is that during the June rise in the upper Missouri River the pressure in the wells rises. No diminution in pressure has been noticed in any of the wells in the district, except by clogging up with mud, due to improper piping. The city well at Redfield has been down seven years. Its pressure has been constant, although numerous other wells have since been sunk at no great distances from it. This well furnishes a direct pressure system of water works supplying all the domestic needs of the city, and so great confidence is placed upon the pressure and supply that the fire department requires no fire engines. The closed pressure of this well is 177 pounds and cost for maintenance is absolutely nothing.

About a mile and a half distant is another well, used for running an electric light plant and for irrigation. A description of this well will suffice to give a fair idea of all. It is 1,000 feet deep, and six inches in diameter from top to bottom. When closed, the pressure is 165 pounds. When allowed to flow freely through the six-inch pipe, it yields 2,027 gallons per minute, and rises to a height of 16 feet in the air. When the water is escaping through a two-inch pipe the well pressure is 128 pounds, and with a 2¾ inch opening 95 pounds. From this it is estimated that with a four-foot Pelton wheel, 80 horse power would be developed with a two-inch opening, and 100 horse power with a 2¾ inch. With the plain undershot wheel at present in place, 50 horse power is developed, and it is calculated that about 15 more is available with it. The flow is absolutely steady. This well cost $3,000.

At Chamberlain a 150 barrel flour mill and light plant, formerly run by steam, is now using "well power." These two plants were started in September, 1893. At Huron a well is about to be sunk by the city, for electric lighting purposes. The first electric light plant in the State, run from a well, is at Mellette, a town of 400 inhabitants. It is safe to say that very few plants in the world are doing a paying business in so small a place. This plant is thriving, however, and has connected 10 four-ampere arcs and 150 sixteen-candle power incandescents. The well is only four and one-half inches in diameter from top to bottom, but it operates, besides the electric light plant, a flour mill, which grinds 150 barrels of flour a day and 50 bushels of feed per hour. This work would require an engine of 40 horse power. The well is 910 feet deep. Its pressure when closed is 178 pounds. The flow is 1,600 gallons per minute.

The outlay for an 80 horse power well is about $3,000, the interest on which would be $2.25 per horse power per annum. This, with the interest and depreciation on the water wheel, is the only expense for primary motive power, aside from labor. A $300 or $400 building gives the wheel and dynamo a good shelter. The repairs to the water wheel ought to be almost zero, and the skill of the men employed for attendance does not begin to be that required in a steam plant.—*Street Railway Review.*

SWAMP ANTELOPES IN THE HAMBURG ZOOLOGICAL GARDEN.

Little more than ten years have passed since these beautiful antelopes—nine of which are now in the possession of the Hamburg Zoological Garden—were first known to the scientific world. It was in 1880 that the learned Dr. P. L. Sclater, manager of the London Zoological Garden, described our antelopes from a skin that was sent him from Gaboon.

Still earlier, in the year 1873, the Hamburg garden owned a swamp antelope, but it was then erroneously classed as a harnessed antelope. The pecul·· appearance of the animal prompted Mr. Leutemann to paint it, and afterward, by the aid of this picture, it was properly classed. After death it became one of the regular exhibits of the Hamburg Natural History Museum.

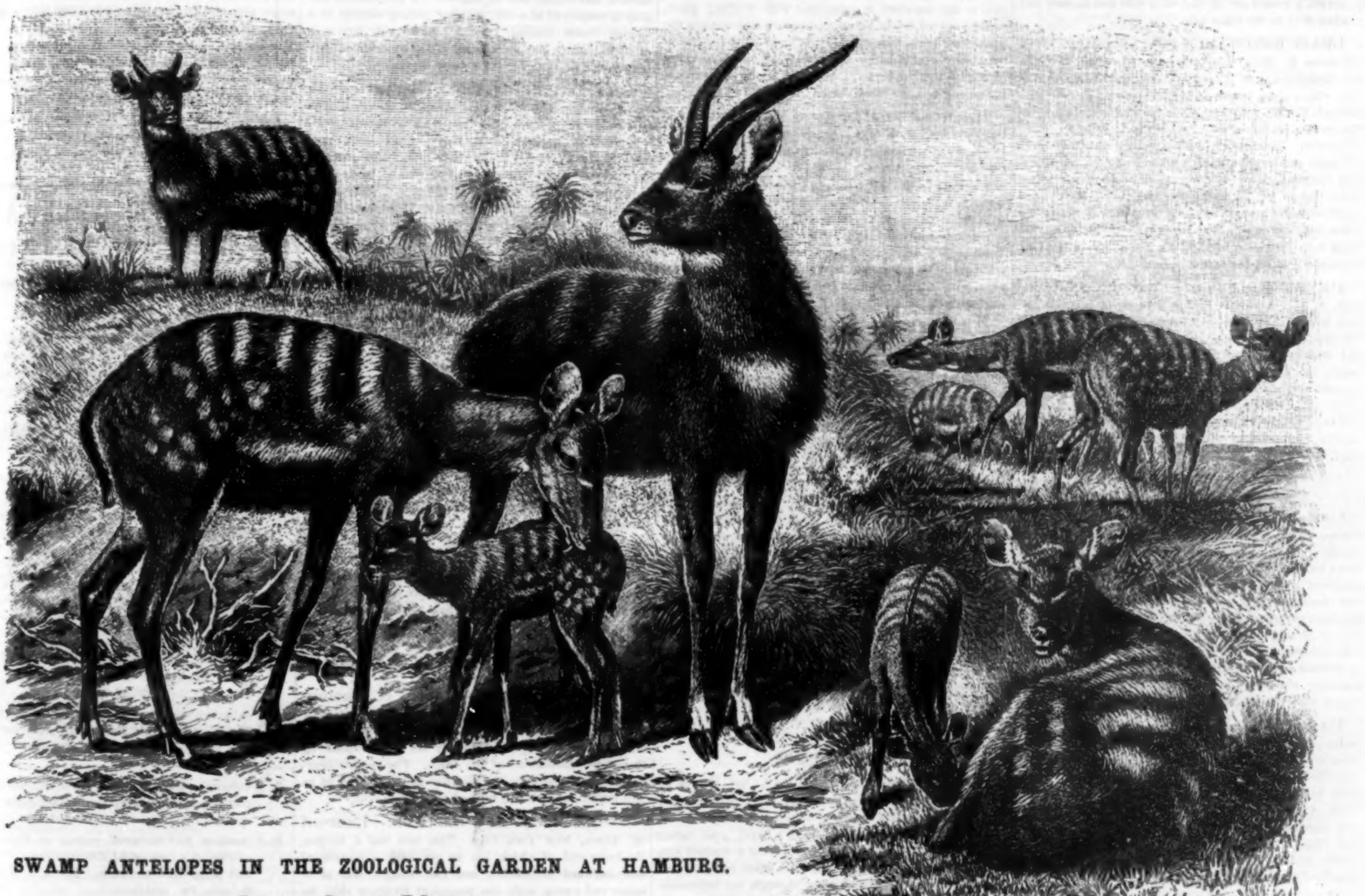
The first two members of the herd that now constitutes the chief ornament of the Hamburg antelope house were two grown females that came as a present from Mr. G. L. Gaiser, who had them brought from Lagos, and sent them to the garden on May 22, 1887. Five years later, a male and two young females were added to the group, and a few months later a second male was presented by Mr. P. Buss, then in Whydah. Three young ones have since been born, thus increasing the herd to its present numbers.

Swamp antelopes (*Tragelaphus gratus*) are beautiful animals; their form is slender and graceful and their coat beautiful in color and marking. Only the males have horns, which are inclined backward a little and are slightly spiral. Their eyes are dark, brilliant and soft, like the eyes of a gazelle; and their large, rounded ears stand out from their heads. The coat of a grown male is of a deep black brown, while that of the young males and females is a beautiful glossy reddish brown. The back, breast and head are ornamented with white spots and stripes; but a narrow stripe down the back is white in the male and black in the female. The hair is longer than that of most antelopes and is coarse, but very glossy.

The hoofs and false hoofs of these creatures are remarkably long and spread somewhat when they step, so that they can easily walk over swampy ground. They love the water, and, even in captivity, like to stand with their feet in the wide, flat tank that has been placed in their cage for that purpose.

Our antelopes endure captivity well, as the experience of the Hamburg Zoological Garden shows. The Hamburg antelopes that were not born in captivity came from Lagos, the Congo, Gaboon and from Whydah. The swamp antelopes extend over more than 1,200 miles of the coast of western Africa, and it is not known how far inland they can be found.

In central and eastern Africa Speke's antelopes (*Tragelaphus Spekii*) are found. They resemble those described above in the form of the body and feet and in the texture of their coat, but have no spots or stripes.—*Dr. Heinrich Bolau, in Illustrirte Zeitung.*



SWAMP ANTELOPES IN THE ZOOLOGICAL GARDEN AT HAMBURG.

FROM LIFE. DRAWN BY H. LEUTEMANN.

Spontaneous Combustion.

The following is the condensed report, published in the *Insurance Monitor*, extracted from the *Weekly London Times*, of an address delivered by Professor Vivian Lewes to workingmen at the meeting of the British Association recently held in Nottingham, England.

The learned professor began by showing how the labors of Priestley and Lavoisier had led to a true knowledge of the actions taking place during combustion, and showed by experiment that in all the ordinary cases of combustion a chemical union was taking place between the constituents of the burning body and the oxygen of the air. The idea of combustion, however, must not be limited to processes of oxidation, although they were the most important; and in order to get a true conception of the action, combustion must be defined as "the evolution of heat during chemical combination." It was then shown that the rate at which chemical action took place was to a great extent influenced by various factors, and that there were many cases in which the action was so slow that the heat escaped as fast as it was generated, and no perceptible rise of temperature took place, and such actions were generally looked upon as cases of "slow combustion." Slow combustion was one of the most important natural actions, and by its means the waste matter in the world was slowly got rid of, and converted once more into simple gaseous compounds, all cases of decay being slow oxidation or combustion. All inflammable substances had a fixed temperature at which they burned actively with flame or incandescence, and this was called the "point of ignition." In some cases an inflammable substance undergoing slow combustion was surrounded with a non-conducting material, and the heat due to the actions going on gradually rose until the point of ignition was reached, and it was this change from the little noticeable slow combustion to ordinary combustion, with its manifestation of flame or incandescence, to which the term "spontaneous combustion" had been given. The lecturer then proceeded to consider special cases of spontaneous combustion, and showed that freshly burned charcoal, especially when powdered, absorbed oxygen from the air with considerable rapidity and with a rise of temperature, which with a large mass was in some cases sufficient to set it on fire. The important bearing of this was that beams, skirting boards, etc., in contact with flues and heating pipes, were liable to become charred at a comparatively low temperature, and this form of charcoal was very liable to spontaneous ignition when air came in contact with it. In the same way coal had the power of absorbing oxygen from the air, and when in masses of a thousand tons or more, especially when much broken and moist, would undergo heating, and even ignition. This was due to the absorbed oxygen setting up chemical action with the hydrocarbons of the coal, and not, as was generally supposed, from the oxidation of the coal. Nearly all the vegetable and animal oils had the power of absorbing and combining with oxygen, and this gave them the power of drying; and one of the most usual causes of spontaneous ignition in workshops and factories was to be found in oily waste or rags, as the oil being spread on the surface of the material offered a large surface for oxidation, while the rags or waste, being excellent non-conductors of heat, allowed the temperature to rise until ignition took place. Well-authenticated cases were known in which sparrows building their nests of oily waste in the eaves of houses had caused serious fires. Hayricks which had been built from grass improperly dried before stacking were also very liable to spontaneous ignition; this being due to the sap of the grass taking up oxygen during a process of fermentation which evolved heat, and the heat being kept in by the surrounding hay, rose until the ignition point was reached. If grass once well dried then became wet by a shower, it became mouldy in the stack, but did not heat. The lecturer then concluded by emphasizing the fact that the so-called spontaneous combustion was merely an increase in the rate of chemical combustion from the slow stage, which was hardly noticeable to active combustion, and showed the fallacy of supposing that the living body could undergo any such action. The demonstrations were interesting, and the conclusion of the lecture was followed by prolonged cheering.

Manganese Nodules in the Ocean.

The *Fortnightly* publishes an article by Prof. J. W. Judd on "The Chemical Action of Marine Organisms, disapproving the chemical theory of the origin of oceanic manganese nodules. He says that all the deep-sea explorations show that this material is collecting very slowly, and he believes that the muds have passed an indefinite number of times through the bodies of marine organisms.

"At each passage of the clay through the organism," he says, "a small addition of manganese and iron oxides would be made to the mass by the action of the living structure on the sea water, and thus, in the course of time, these oxides might be sufficiently concentrated to build up, by concretionary action, the remarkable nodules on the ocean bed.

"Such action would be in complete analogy with processes going on in fresh and salt water, by which calcareous, siliceous, phosphatic, and ferruginous deposits are being everywhere formed in the waters of the ocean, while all theories of the direct separation of the manganese and rarer metals from their state of excessively dilute solution in sea water by chemical reactions appear to me to be beset with the greatest difficulty."

RECENTLY PATENTED INVENTIONS.

Engineering.

VALVE GEAR.—Jehial Spencer, Milledgeville, Ill. A reciprocating slide is, according to this invention, adapted to be actuated from the engine pitman, and connected by an arm with a block held to slide in a link, and connected with the valve stem. The valve gear is in this way actuated from the pitman, is of simple and durable construction, very effective in operation, and is designed to cause the engine to utilize the steam to the fullest advantage, permitting of conveniently reversing the engine at any time.

POWER HAMMER.—James B. Sweeney and Robert W. Laird, St. Johnsbury, Vt. A revoluble drive shaft forms the fulcrum of a helve having a split end in this device, the vertically reciprocating hammer being arranged opposite the split end of the helve, in which is held a spring projecting into the hammer head, a box receiving the spring, and the box being pivoted and held to slide horizontally in the head. The improvement affords a very simple and inexpensive hammer, designed to deliver an elastic blow similar to one given with a hand hammer, the hammer being nicely adjustable to regulate the stroke.

PROTECTING LANDS FROM OVERFLOW.—William and Harper McCaughan, Gulfport, Miss. This improved means of protection for river banks provided with levees consists in forming an outlet channel leading to a lower reservoir, the channel also having levees upon each side, but having near its mouth a dam just high enough to permit overflow when the danger point is reached, the river at all other times flowing in its normal channel. The dam is inclined on each side of its middle to permit a steady rise on the river side and an easy and gradual flow on the other side.

LEAST RESISTANCE FOR VESSELS, ETC.—Francis E. Mills, San Francisco, Cal. This inventor has designed a form of body which, either solid or hollow, with a given length and end displacement, will pass through the air, water, or other resisting medium, with the greatest sustained velocity and the least expenditure of power. Such body consists mainly of two laterally adjoined and longitudinally reversed wedges, connected and merged together laterally by four sides whose transverse planes are at all points diagonal to the lines of taper of both wedges, twisting transversely ninety degrees in their length and merging in chisel form ends. Such body is adapted for military and other projectiles, boats and floating craft, etc.

DREDGER.—Samuel P. Hedges, Greenport, N. Y. The frame of this dredger is portable and may be placed on a float, extending over the edge, and the construction is such that the dipper arm is under the entire control of one individual, who is able to swing the crane in any desired direction, control the upward movement of the dipper arm, its inward and outward movement, and its plunging movement to reach the soil to be removed, the operator also holding the dipper arm in fixed position while the dipper is receiving its load.

Railway Appliances.

CAR REPLACER.—Albert S. Debose, Cuero, Texas. This device comprises two triangular blocks rigidly connected by transverse tie rods, each block having side flanges, a curved upper surface, a longitudinal groove in its upper surface, a slot at the broad end communicating with the groove, and a central longitudinal rib tapering toward the broad end of the block and projecting into the slot. The improvement forms a very cheap and simple device, which can be quickly set in place at any point where a car has been derailed, to facilitate replacing the car on the track, either in the ordinary roadbed or upon a bridge.

CAR DUMP.—Hiram P. Williams, Somerdale, Ohio. This is a dumping mechanism upon which a car or other vehicle may be readily placed and held so that the load may be dumped from either side of the vehicle by the use of a motor or the strength of one or two men. Combined with a drive shaft carrying gear wheels is a number of disk-like cradles, each having in its upper edge a recess extending below the center of the cradle, and teeth on its periphery, the cradles being eccentrically mounted on a rock beam.

CAR BRAKE HANDLE.—John Marrissett, Vancouver, Canada. A pulley is, according to this invention, rigidly secured on the brake shaft, and adjacent on the shaft is a loosely supported bracket in which is fulcrumed a handle adapted to frictionally engage the pulley, there being a stop to limit the movement of the handle in one direction. When the crank handle is turned in one direction the chain is wound on the shaft in the usual way, applying the brake, but when the brake is released, the shaft turns without turning the crank handle, obviating the danger of one being struck and injured by the rapid reverse movement of the crank handle.

MILEAGE BOOK.—William Boll, Red Oak, Iowa. This is a very handy and simple book, having an extensible mileage strip, keeper plate, gauge strip and reel, with a guard flange on the keeper plate, the mileage strip being adapted to be severed without severing the gauge strip. The book is designed to have all the advantages of the customary mileage book, with the additional one that a certain length of strip represents a certain value, so that the strip may be easily torn for the amount desired and a mistake is not likely to be made.

CAR SEAL.—Benjamin J. Sturtevant, St. Paul, Minn. This seal for car doors, mail bags, etc., is very simple and durable, cheaply manufactured and easily applied. It consists of a tag made of clay or other suitable material, formed with a recess into which opens a slot, a spring hook being adapted to be drawn into the recess, and having sharp or pointed ends engaging the walls of the slots.

Electrical.

ARMATURE CONNECTION.—Oza Dufault, Spencer, Mass. This is a simple and effective device for connecting the terminals of armature coils with the commutator bars. Combined with the commutator bars is a terminal piece for attachment to the end of the armature conductor, and a winding of a cord of insulating material for holding the end pieces in contact with the arm of the commutator bar.

ELECTRIC ALARM.—Samuel T. Sanders, Granite, Montana. This alarm is more especially designed for use in mines, to automatically signal to the engineer the arrival of the cage near a gallery at the time the chairs have been moved into the mine shaft to support the cage. The invention consists of an insulated slide connected with the mechanism for operating the chairs in the galleries, conductors held on the slide and connected with the circuit wires, and a circuit-closing arm on the cage adapted to engage the conductors to close the circuit to sound the alarm.

ELECTRIC LOCK.—Robert V. Cheatham, Louisville, Ky. No key is employed with this lock, which is suitable for use on all ordinary house doors, especially those leading to the outside, as it cannot be opened unless one knows the combination. The mechanism comprises a series of push buttons, a circuit closer connected with certain of the buttons, and an electro-magnet connected with some of the circuit closers, the armature lever of the magnet normally locking the door bolt. The battery for the electric door bell also serves as the battery for this lock.

Mechanical.

LIFTING JACK.—Walter Johnson, Middletown, Conn. Under the special construction provided for by this invention the jack may be locked at any height to which it may be adjusted. The standard has opposing binding surfaces, and a handle lever pivoted to the standard is connected with a lifting piece, while a curved detent bar plays between and engages the contact surfaces, a lever bent from a rod of metal forming a short arm linked to the detent bar, portions being pivoted to the handle lever, and with a long arm extending adjacent to the handle lever.

MACHINE FOR BORING FRAMES TO BE CANED.—Karl F. G. Maier, Baltimore, Md. In this machine, when a form is placed in front of the boring tool, the form is automatically shifted to constantly present a new surface of the seat frame to be bored, simple means being provided for driving the boring tool simultaneously with the operation of the form, and giving to the boring tool a timed advance and return movement. The machine is very simple, compact, and inexpensive, and is designed, with a boy's attendance, to accurately do much more work than an experienced hand can do on the common upright machine.

PRINTER'S GALLEY.—Emil Lau, Brooklyn, N. Y. The side and head pieces of this galley have mitered abutting parts to form a corner, and a pin extends longitudinally into the side and head piece, the pin having transverse nicks or grooves, while fastening pins extend transversely through the side and head piece and through the nicks, thus making a galley which shall be as light as possible, while especially strong and true at the corners.

PRINTING PRESS PERFORATOR.—Joseph T. Scott, Cœur d'Alene, Idaho. This is an attachment for an ordinary printing press to enable the paper to be automatically perforated at the same time it is printed. It is an elongated case with open upper side to be locked into the type form, there being a slide bar in the bottom case provided with cams and a spring between the end of the case and the slide bar, while an angular lever is pivoted to the case, and a perforated bar above the slide bar is provided with perforating brads. The angular lever is adapted to contact with a block carried by the platen to cause the brads to perforate the paper, the perforator bar and brads being driven in the case as soon as the impression is made.

Miscellaneous.

PNEUMATIC ROAD CLEANING SULKY.—John Jacob Astor, New York City. The two wheels of this road cleaner are loosely mounted on the axle, and on the inner face of one of them is a bevel gear facing a similar gear splined upon and having a limited longitudinal movement on the axle, the gears being thrown into engagement with each other through an intermediate pinion, by means of a handle lever within ready reach of the driver. By the revolving of the axle, on the movement of the lever, a double acting bellows is operated to afford an air blast, the bellows being supported by brackets from the platform, and the link and pinion connection being such that the rapidity of the operation of the bellows may be readily regulated to supply a more or less powerful current. The bellows has a supplemental nozzle, which may be moved vertically or carried to either side of the machine, and that the dust may not fly upward as it is blown from the road when the cleaner is drawn forward, a hood is made to cover both the nozzle proper and the auxiliary nozzle. This cleaner is designed to effectively clear the roadbed of dust, or any light or loose foreign matter, depositing the removed material along the line of the road. This invention was illustrated and described in the SCIENTIFIC AMERICAN of September 3, 1892, and a fine working model was on exhibition at the World's Columbian Exhibition last year, where it attracted much attention.

LEATHER MEASURING MACHINE.—Jules E. Fortin, Quebec, Canada. The measurement of leather by this machine is effected by the disposal of numerous little weights hung at regular distances apart, each weight representing a certain space or area, and the weight by their displacement affecting the scale beam. The parts are so arranged that by raising a side of leather against the suspended weights, and effecting the balance by a counterpoise on the scale beam, the size of the side of leather will be indicated in feet and inches on the beam.

WOVEN CHENILLE FABRIC.—Leedham Binns, Philadelphia, Pa. As a new article of manufacture, this inventor has devised a strand of chenille comprising separated sets of warps, wefts binding each separated set, the wefts of the several sets crossing each other at their middle and between the separated sets of warps, the ends of the wefts projecting from the outermost warp threads in the several sets forming tufts or loops, while a core thread extends through the space formed by the crossing wefts.

BOAT.—Alfredo D'Costa Gomez, Bucaramanga, Colombia. This inventor has devised a style of boat especially adapted for the navigation of shallow water, or for streams in which there is considerable current. For the ordinary hull of a vessel is substituted a series of floats made of hollow cylinders of light metal, pointed at the forward end, each float having on its upper surface a longitudinal beam, and the floats of each series being connected by transverse beams, the latter being connected by deck beams, upon which is supported the deck and other desired structure.

PLATFORM RAILWAY.—Thomas Ke:)nedy, No. 36 West 116th Street, New York City. According to this invention a central standard in a circular base constitutes a pivot or guide for a circular platform of solid or skeleton construction, upon which are circular tracks for cars or carriages, the platform, in addition to its central bearing, being partially supported by vertical springs arranged in a circle at a distance from the central standard, the springs being of different lengths, with the longer one at one side, so that the platform will normally be held in an inclined position. By alternately depressing the high side of the platform and permitting it to rise by the action of the springs, single cars or carriages, or trains of vehicles, may be made to travel constantly around the track, the rocking movement of the platform being effected by a motor, or by a rope or chain pulled by hand. The improvement affords an entirely safe construction for merry-go-rounds or carrousels, giving the occupants of the cars a smooth and regular undulating or rocking motion, and it may also be utilized for purposes of display or employed as a toy, making rolling objects or a display frame exhibit various articles. A figure or group of figures may be secured upon the central portion, to remain stationary or revolve therewith.

BICYCLE SUPPORT.—Benjamin B. Davis and James F. McGowan, Athens, Ga. This is an extensible prop having at one end a fastening by which it may be secured to the bicycle frame at front rod between the upper and lower main tubes, and provided between its ends with a clasp adapted to engage and scotch the wheel, the free end of the prop resting on the ground. The device is very simple and inexpensive, and may be readily applied to and removed from the machine.

HARNESS ATTACHMENT.—Edward K. Griesemer and John H. Manger, Reading, Pa. Combined with the breast collar of a harness and the thill of a vehicle is a spring clip to clasp the thill, one member of the clip terminating in a socket and the other member projecting into the socket, the free end of the clip being adjusted by a screw, while a lug on the breast collar enters the socket and is engaged by a catch. The improvement forms a simple means of attaching a horse to the thills, being especally adapted for a light harness, forming also a supplemental attachment to an ordinary harness, and a safeguard against accident.

BRIDLE BIT.—Robert Sears, Newark, N. J. The cheek pieces or guards, according to this invention, have extensions with eyes, the extensions forming bit-receiving recesses open from the edge of the cheek pieces, in which loosely fit the ends of a jaw strap, the strap being detachable from the eyes to permit entrance of the bit. This attachment for check reins may be applied to an ordinary bit, to prevent chafing of the horse's mouth, and when used in connection with a chin strap makes the checking action more effective, supporting the chin strap nearer the point of the jaw and preventing undue straining of the strap or the bit.

THILL COUPLING.—James S. Patten, Baltimore, Md. A simple construction of latch-plate and actuating devices has been provided by this inventor, the latch being automatically set and released by the proper movement of the thills. The device operates efficiently to take up all wear and also acts as an anti-rattler, while it can be made at a small cost.

SWORD B'LT AND HANGER.—Laurent H. Allien, New York City. This belt has a keeper, the lower end of which has an eye with a downward and outward inclination, and the hanger has at its upper end a snap with the tongue at its inner side, the snap engaging the lower end of the keeper. The hanger and sword may be quickly and easily removed from the belt or arranged in engagement therewith without displacing the coat or disengaging or upturning the belt.

BANDOLIER.—Joseph Bertrand, Houghton, Mich. This article consists of a suspending strap or band, a pendent apron with sheath or pocket inclosing a rigid and perforated plate, while a load hanger is adjustably connected to the apron on the outer face. This bandolier is very simple, durable and inexpensive, and is designed to assist porters or others in the carriage of various articles, permitting of the load being carried as far from or as near to the waist line as possible.

HOSE COUPLING.—Patrick J. Barrett, Boston, Mass. The two sections of this coupling, when pressed together, become engaged by a slight turn or twist, there being on the exterior of one section teeth engaged by a tilting pawl on the opposite section, while a revoluble collar adjacent to the pawl has a cam slot engaging the shank of the pawl. The coupling makes an absolutely watertight joint, affords a clear waterway, and is so made as to facilitate the attachment of an electric signal to a hose.

SLIDING LADDER.—William J. Thurwanger, Philadelphia, Pa. This is an improvement in ladders designed to be pushed back and forth opposite a row of shelves. The construction is such that the ladder will be held very steadily and its foot prevented from swinging laterally, while the ladder and its supports may be easily applied to the ceiling or the shelving of a room.

WRITING TABLET AND MANUSCRIPT HOLDER.—Barton W. Scott, San Jose, Cal. This is a casing made in the shape of a book, with two winding rollers for the paper, and a spring-actuated mechanism in the casing adapted to be connected with either roller to move the paper up or down. The device is more especially designed for the use of reporters, writers, public speakers, etc., the matter being written on a continuous sheet or web of paper.

MUSIC STAND.—Frances Higbie, Brooklyn, N. Y. This invention provides an improvement in clamp joints, whereby any horizontal object, such as a music rest, bracket or table, may be adjustably held upon an upright support without the use of set screws, etc. The construction is such that the bracket or table, when moved to the desired point upon the standard, will remain stationary, and the more weight it carries, the more firmly will it be held to the standard.

METAL PIPE CONNECTION.—Patrick J. McGuire, New York City. This is a connection especially adapted to unite sections of soil pipe and prevent the passage of sewer gas. It comprises a conically enlarged hub in which is seated a mating joint ring, a soft metal joint ring being formed between a cylindrical extension of the conical hub portion, while there are external threads on the inserted pipe section. With this construction the work of putting up soil pipe in a building may be materially expedited.

DUPLICATE WHIST.—John G. Butler, Augusta, Ga. The novel shaped tray devised by the inventor for playing this and other games of cards is cruciform, with raised border and card receptacles in the branches, in which are projections to confine the cards in a given direction, with freedom for removal when required. The improvement facilitates the playing of the different "hands" over again, either by the same partners or by transferring the hands intact to opponents.

BASE BALL BAT.—Charles Jacobus, New York City. In a longitudinal axial bore of the bat, according to this invention, are placed heavy balls, a screw plug closing the outer end of the bore, and facilitating the placing or removing of the balls. As the bat is swung for a stroke the balls slide outward, to increase the effectiveness of the blow, the balls moving toward the handle end, and thus decreasing the weight of the bat, when the latter is held upright.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

Business and Personal.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(5832) T. H. De S. writes: Given a pump in a position where the water pressure, due to the elevation to which the water has to be put, is 92 pounds per square inch, and with such size discharge pipe that when the pump is delivering 200 gallons of water per minute the pressure runs up to 180 pounds, now if a larger size discharge main is used, of such diameter that, when 200 gallons is still delivered, the pressure is only 120 pounds, what is the saving expressed in horse power? Please give the formula. A. The formula is the hydrostatic height in feet saved, multiplied by the weight of water pumped, and product divided by 33,000 equals the horse power saved. As in the case stated, 180 pounds − 120 pounds = 60 pounds × 2·3 = 138 feet hydrostatic height saved. Then 138 feet × 200 gallons × 8⅓ pounds = 229,908 foot pounds, and $\frac{229908}{33000} = 7{\cdot}27$ horse power saved by the change.

(5833) H. C. P. says: Will you kindly tell me what the compound is made of that is used for coating the inside of wooden battery cells to make them acid-proof? A. Have boxes perfectly dry, smear them inside with a hot mixture of 4 parts resin, 1 part gutta percha, and a little boiled oil. The mixture must be thoroughly melted and stirred before use. A hot rod of iron may be used to melt it into the crevices. They can be used for any ordinary type of battery.

(5834) A. O. writes: I have a sink in which the waste water from the kitchen is poured and carried through four inch sewer pipe to a hole sixteen feet deep and 2½ feet in diameter, 250 feet distant from the house. The top of the ground at this hole is four feet lower than where the waste pipe leaves the house. The hole is walled up loosely with boards to keep the earth from caving. A very disagreeable odor emanates from the sink, worse in the winter. The hole is covered and I have a ventilator shaft 6 inches square and 4 feet high over it, but it makes no difference as to the odor emanating from the sink whether the ventilator is open or closed. Can you suggest a remedy? A. If you have no trap in the waste pipe, the warmth of the house in winter will increase the draught through the open sewer pipe, and thus increase a nuisance and danger that should not be tolerated under any plea. Put in a good deep trap as close under the sink as possible and as large as the sink pipe. Give it an occasional flush with hot water, and you will have no further trouble with sewer gas.

(5835) Beta asks: 1. How long a line can the magneto telephone, used both as transmitter and receiver, be worked upon with good results, and what size iron wire should be used? A. It can be used over very long lines if of copper with metallic circuit. Up to 10 miles No. 12 iron wire will answer. 2. Can a single wire with ground connections be used on a line two miles in length, or is a complete metallic circuit very much better? A. Yes; but the full circuit is preferable if there is any induction. 3. Would there be any advantage in volume of sound and workable distance in making the magneto transmitter larger than the standard Bell receiver? A. As far as experiments have gone, there would not. 4. How many cells of Leclanche battery would be required to ring a call bell on a line two miles long, single wire with ground connections, or double, if, according to your answer above, a metallic circuit is to be preferred? A. Two to four.

(5836) P. R. asks: Will liquid mercury attack tin or galvanized sheet iron? Will ammonia pure, or its vapors, attack the same? Which would be the best things besides glass to hold both liquids? A. An iron vessel is excellent for mercury. It will attack tin and zinc and become injured. Ammonia attacks zinc and attacks iron even if tin plated. Gutta percha or stone ware may be used for ammonia. Glass is generally employed for it.

(5837) G. R. L. asks: 1. Are there any substances that are not magnetically transparent? If so, what? A. Iron and steel absorb most of the lines of force. There is no substance such as you refer to. 2. Will you please explain the principles of the duplex telegraph and the quadruplex telegraph? A. For duplex telegraphy we refer you to our SUPPLEMENT, Nos. 694, 702, 796; for multiplex telegraphy to the same, Nos. 457, 461.

(5838) W. C. V. asks: 1. Is the use of glucose as a food injurious? A. Not if pure. 2. Are there other sweets than glucose, which are produced by chemical processes, in the markets for table use? A. Saccharin. 3. How can one plant a cocoa nut in this country and succeed in having it grow? A. Success would be very doubtful except in southern latitudes. Address the Department of Agriculture.

(5839) W. L. B. asks: I have a dynamo 30 volts 8 amperes when wound with 8 pounds No. 14 wire on fields and 1½ pounds No. 18 on armature. What sizes of wire should be used to obtain a potential of 50 volts, using shunt field? A. Wind armature with 1¾ pounds No. 22 wire. Call its resistance 4 ohms. Then the field must have a resistance of 93¾ ohms. This would be given pretty closely by 8 pounds No. 18 wire.

(5840) G. E. B. asks why it is that some tower clocks have such very heavy pendulum bobs, as heavy as 500 pounds. A. Heavy pendulums are made to counteract the effect of vibration in towers by wind or other causes, which produces an irregular beat in light pendulums. The heavy pendulum also lessens the pendulum rod vibration due to the beat of the pallets.

(5841) H. G. A. asks if fifteen convolutions of wire on a spark coil would make a larger spark than 8 convolutions. A. Yes.

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Spraying oil or other liquids, apparatus for, L. L. Merrifield	514,962
Stamping block, I. Davis	515,047
Stand. See Barrel stand.	
Steam and drain trap, automatic, F. Lamplough	515,293
Steam and gas motor, combined, J. G. Lightford	515,295
Steam and removing extraneous matter, apparatus for purifying, C. M. Baum	515,105
Steam engine, oscillating, R. E. P. Treadwell	515,180
Steam generator, J. A. & G. W. Welton, Jr	515,267
Steel bars, machine for upsetting the ends of, R. H. Bourne	515,120
Steering gear, electric, F. L. Dyer	515,296
Stove, Horton & Quest	515,147
Stove, Voegtly & Schroeffel	515,065
Stovepipe or flue cleaner, A. Y. Graham	515,314
Stump extractor, E. Oneill	515,158
Surgical chair, J. E. Rouse	515,303
Switch. See Railway switch.	
Switchboard system, D. H. Wilson	514,980
Swivel, F. Salathe	515,023
Syringe, C. D. Harsin	515,288
Table. See Billiard table.	
Tack driving machine, R. Woodward	515,289
Tag, envelope, and receipt, combined shipping, N. J. Bishoprick	515,275
Tags and counting and separating same into piles, machine for making, C. E. Sawyer	515,024
Tap wrench, A. H. Kent	515,292
Tea, coffee, etc., apparatus for making, J. Childs	514,988
Telephone, D. Drawbaugh	514,916
Telephone pay stations, automatic toll box for, H. C. Root	515,170
Telephone receiver cushion, V. A. Cook	514,913
Telephone transmitter, P. Fitzsimons	514,920
Thread cabinet, H. T. Luster	514,947, 514,948
Thread unwinding apparatus, M. V. Palmer	515,160
Time alarm, electric, J. C. Betts	515,189
Tire, pneumatic, D. P. Sims	515,134
Tire repairer, pneumatic, C. E. Buckbee	515,284
Tongs, pipe, W. King	515,936
Tongue support, T. N. Savage	515,090
Top, spinning, G. H. Hyne	514,946
Transformer, F. S. Hunting	514,938
Trap. See Animal trap. Insect trap. Mole trap. Steam and drain trap.	
Tray, serving, H. L. Palmer	515,161
Trimming, dress protector, G. H. Taylor	515,027
Triturating and powdering machine, A. B. Hall	515,217
Trolley conductor and support, M. D. Law	515,238
Trolley wire support, R. M. Hunter	514,982
Truck, barrel, J. J. Becker	515,273
Truck center plate, car, W. J. O'Byrne	515,246
Truck, dry kiln, lumber, F. Kirk	515,232
Truck, vehicle, W. Voss	515,080
Trunk, wardrobe, W. Deutsch	515,118
Tying machine, L. S. Burbank	515,143
Typewriting machine, S. L. Conde	514,909 to 514,912
Valve, Ives & Colman	515,290
Valve and steam trap, automatic drain, F. Lamplough	515,294
Valve operating mechanism, J. W. Ogden	515,247
Valve, steam-actuated, T. J. Piers	514,962
Ventilator, J. A. Ashburn	515,098
Wagon brake, automatic, F. A. V. Theiander	515,264
Watchmaker's bench tool, C. A. Stebbins	514,971
Wheel. See Bearing wheel. Cycle wheel. Gear wheel.	
Window operator, Smith & Pile	515,061
Window screen, C. S. Norcross	515,054
Windows, framing for stained glass, H. A. Lewis	515,052
Wire and ribbons, machine for hardening and tempering steel, E. Ashworth	514,986
Wood, compound for bleaching and preserving, S. Cabot	515,191
Wool oiling product, E. Godchaux	515,077
Wrench. See Tap wrench.	
Wrench, D. H. Carpenter	515,070
Wrench, W. Houghton	514,998
Zinc, manufacturing oxide of, E. O. Bartlett	515,043

TRADE MARKS.

Boots, shoes, and footwear manufactured of leather and cloth, ladies', Rumsey Brothers	24,245
Brick, tile, and articles made of fire clay, fire, Harbison & Walker	24,272, 24,273
Canned fruit, vegetables, and fish, except oysters, R. H. Macy & Company	24,254
Cigars, Weeks & Potter Company	24,246
Cotton goods, J. W. Woods & Son	24,265
Dress shields, Amolin Company	24,244
Dressing for giving a finish to textile fabrics, A. M. Fyfe	24,248
Flour, wheat, Pindell Brothers & Company	24,252
Grain products, milled, Mauston Milling Company	24,268
Gum, chewing, Faultless Chemical Company	24,249
Hog, beef, and mutton products, smoked, Jacob Dold Packing Company	24,267
Lard substitutes, N. Morris & Company	24,253
Licorice lozenges, Young & Smylie	24,250
Medicinal preparation for liver diseases, J. H. Zeilin & Company	24,258
Peanuts, Columbia Peanut Company	24,251
Perfumery, C. G. Buck	24,262
Polishing paste, Lubszynski & Company	24,247
Quinine, preparation of, Billings, Clapp & Company	24,275
Razor strops, G. N. W. Wilson	24,262
Remedies, certain named, R. H. Macy & Company	24,256
Remedy, headache, Oak Chemical Company	24,257
Remedy for gonorrhea, Scureman Drug Company	24,271
Remedy for lung and nervous diseases, Billings, Clapp & Company	24,270
Remedy for rheumatism, gout, and lumbago, W. H. Corbit	24,259
Sash locks and door bolts, H. B. Ives & Company	24,260
Sewing machines and attachments, Williams Manufacturing Company	24,274
Shoes, ..en's and boys', J. P. Twaddell	24,264
Tea, coffee, and other named beverages, United Kingdom Tea Company	24,269
Toilet preparations, certain named, R. H. Macy & Company	24,255
Trees, seeds, bulbs, and plants, E. H. & K. E. Ricker	24,266
Turquoises, New Mexican, Azure Mining Company	24,263
Watch movements, J. J. McGrane	24,243

DESIGNS.

Book marker, B. S. Samuels	23,076
Ceilings, center piece for metallic, W. S. Grafton	23,081
Cracker or similar article, E. Ivins	23,078
Dish, cover, C. A. May	23,077
Exhibition stand, I. Hermann	23,079
Grate, air, J. Fischer	23,080
Necktie, G. H. Taylor	23,074
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Trimming, G. H. Taylor	23,073
Vault light frame, J. Jacobs	23,082
Vault light lens, J. Jacobs	23,083

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